

PC
MAGAZINE

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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING JUNE 10, 1997 VOL. 16 NO. 11

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Much More than Just Fast Output

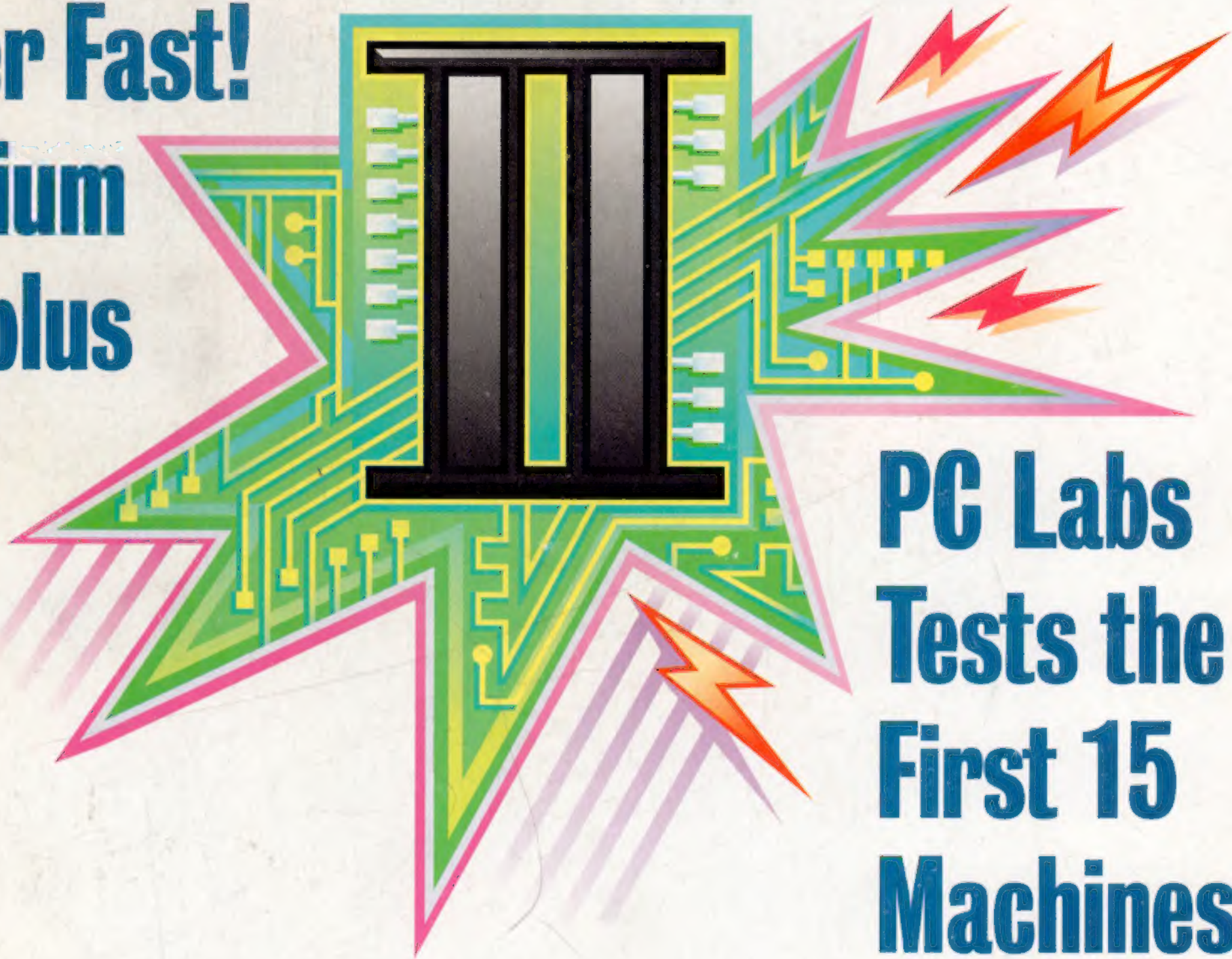
Push Servers The Hype and Hope of
Push Are Put to the Test at PC Labs

NETWORK EDITION

Disarming the Internet 5 Ways to Stop
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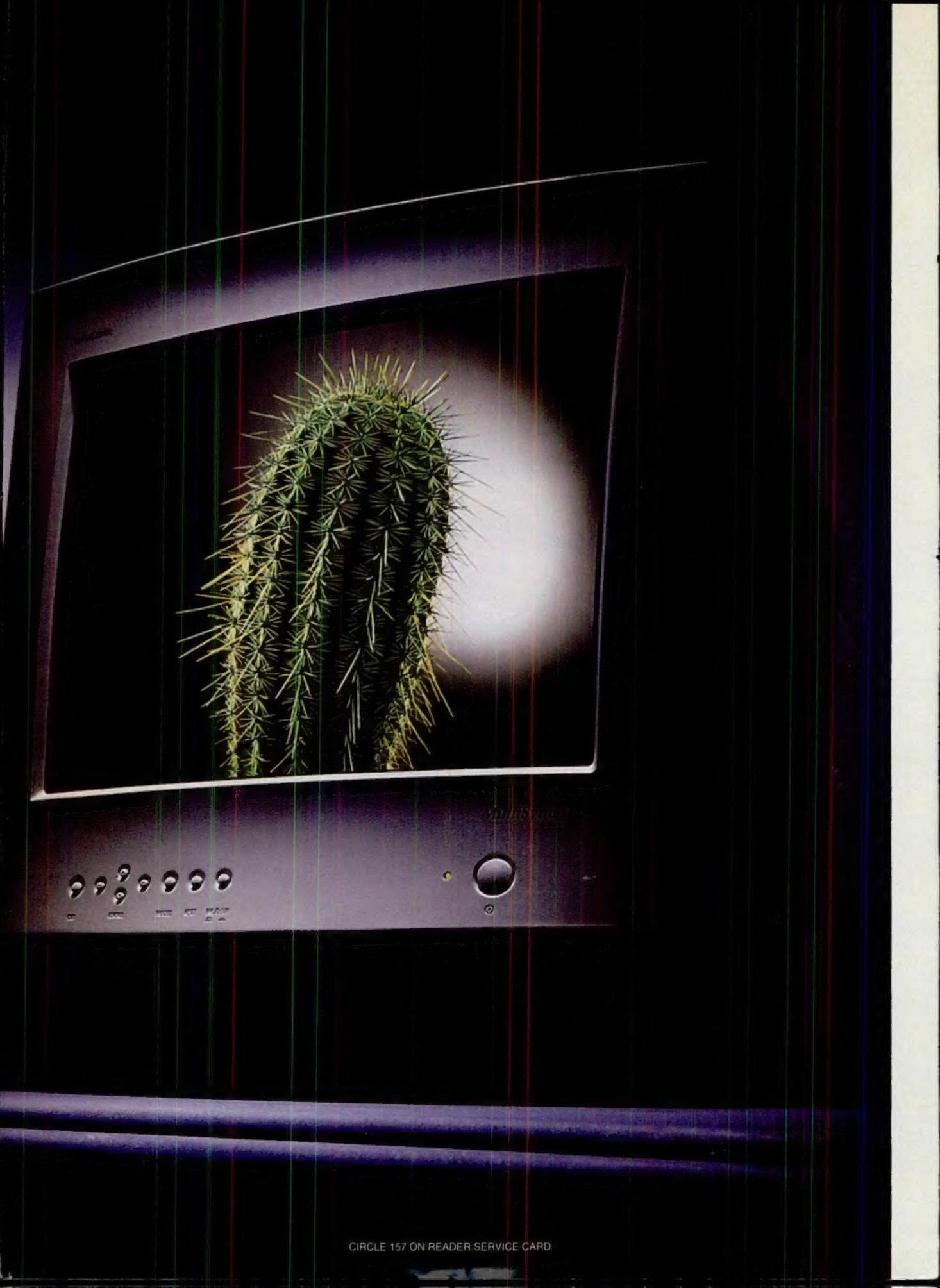
PENTIUM

Super Fast!
Pentium
Pro plus
MMX



PC Labs
Tests the
First 15
Machines

EXACTLY HOW SHARP IS THE
PICTURE ON AN NEC MULTISYNC
MONITOR WITH CROMACLEAR?



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New Chips on the Block



Picking a processor was once easy. If you were a power user or someone who liked the best, you bought the CPU with the highest or second-highest MHz rating. Otherwise, you bought slower-speed

CPUs or those from the previous generations.

Those days are gone.

New CPUs from Intel, AMD, and Cyrix give you more choices than ever.

Intel still offers the original Pentium processor—often called the classic Pentium—though it tops out at 200 MHz. Intel also offers the new Pentium Processor with MMX Technology, now up to 200 MHz, with faster versions coming soon. The Pentium Pro also tops out at 200 MHz but remains a viable chip in multi-processor workstations and servers. For its new Pentium II, Intel took the basic Pentium Pro architecture, raised the clock speed, added MMX instructions, and fixed many of the problems it had with running Windows 95 applications. Today, it's available at 233- and 266-MHz speeds, with 300 MHz and even faster versions on the horizon.

The good news is that Intel isn't alone. AMD recently shipped its K6 processor, which performs close to the Pentium II but is less expensive. Cyrix introduced its inexpensive MediaGX chip and is feverishly working on the M2, a Pentium II competitor.

The chart accompanying this column shows just how fast the new CPUs are, according to our Business Winstone benchmark tests. I don't recall any time when we had so many compatible processors. The competition among CPU vendors will help create less expensive, more capable computers for all of us, which is great news.

But what should a consumer buy? The first thing to do is to understand the new processors. Later in

this issue, Bill Howard gives you his opinions of the various chips (page 95). Then, our cover story offers reviews of the first 15 Pentium II systems (page 100). Here are my recommendations.

If you're looking for an inexpensive desktop, one based on the original Pentium processor can be a good deal. It will do an acceptable job with today's applications, though

it won't be ideal for all the new applications I expect to see in the next 12 to 18 months—particularly entertainment and graphical titles. If you can afford a bit more, K6 systems should offer the best price/performance ratio, but you'll find greater variety in systems that have Pentium processors with MMX. Either

choice will give you the ability to run MMX-enabled applications when they appear, but I'd make sure to get 32MB of RAM. Also, if you're buying for the home, be prepared to spring for a DVD upgrade when prices come down and more titles become available. For real power users, the top end is Pentium II chips, and I expect them to be more aggressively priced than many believe.

Server buyers will find good low-end servers based on Pentium II and Pentium Pro processors. For scalability, the Pentium Pro still is the chip to beat, because of its larger on-board cache and its ability

to work in four-processor configurations. For notebooks, I may stick with the classic Pentium for a while because I value battery life, and most of the things I do on the road don't seem to take advantage of MMX. But for a presentation machine, MMX gives you a better kick.

More processor choices may be confusing, but more competition means we're all going to win.

MICHAEL J. MILLER

Business Winstone

Benchmark test scores

Pentium II/266 54

Pentium II/233 51

AMD K6/233 51

Pentium MMX/200 44

Pentium Pro/200 43

Pentium/200 39

Average for systems with
Windows 95 and 32MB RAM.

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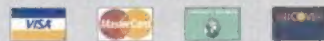
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COVER STORY

Pentium: Part II

BY CADE METZ

Intel knows how to keep 'em coming back, following each act with something better. The Pentium II debuts right on the heels of the release of the Pentium Processor with MMX Technology. We review 15 of the first Pentium II systems out on the market, from 266-MHz business models to multimedia workstations to models geared for the home. Although prices jump, the power soars. You'll see the difference100

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ONLINE



What's New Online

Is the Pentium II right for you?

If you're shopping for a new PC, you

need to know how the new Pentium IIs stack up. Check them out through our exclusive online interactive benchmark test viewers and our interactive summary of features. Join us online at www.pcmag.com.

UP FRONT

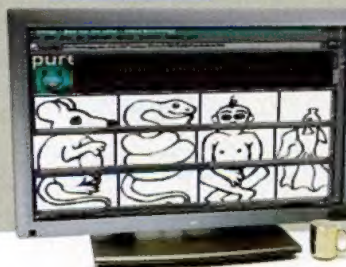
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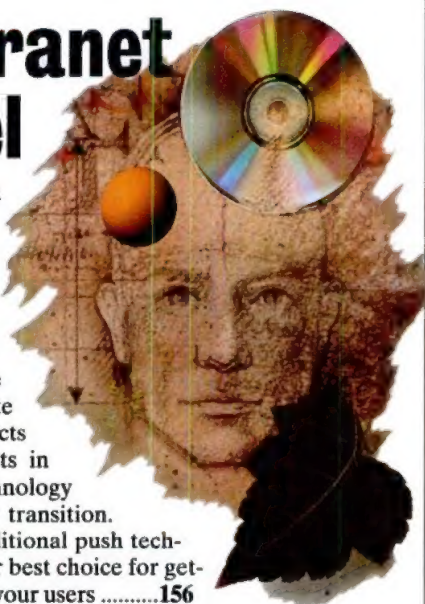
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The Intranet Channel

The *push* is on for your corporate intranet. You knew it was only a matter of time until this popular technology jumped over from the Internet. But is the time right? We evaluate four push server products with corporate interests in mind. This slick technology may not make an easy transition. Right now, a more traditional push technology is probably your best choice for getting information out to your users156



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Don't
Copy**

Don't make copies of that report—print it! Laser printers have finally caught up with the office copier in speed and capability. Consider one of these models183

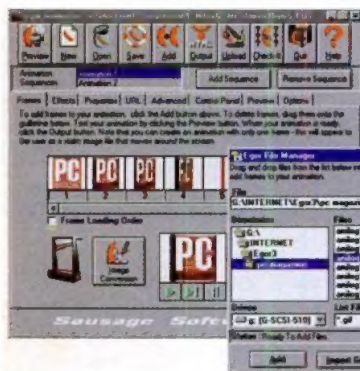


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Java: Create Your Own Applets

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NETWORK EDITION

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Upgrade to OmniPage Pro and get the recognition you deserve.

OmniPage Limited Edition or **OmniPage Lite** is the OCR that came with your scanner. They give you basic OCR.

How to Improve Your OCR Accuracy and Save Big \$\$\$

Caere Corporation (NASDAQ: CAER) recently announced an upgrade that makes the OmniPage Pro optical character recognition (OCR) major software resellers for an estimated street price of only \$129. This is an inexpensive way for scanner users to step up to fully-featured OCR products (including those bundled with flatbed and edge feed products) can upgrade to the full version of OmniPage Pro at a \$30 mail-in rebate.

OmniPage Pro has a separate upgrade package available through Computer City, Egghead, and Best Buy. Since the vast majority of Caere OCR, most scanner users are eligible to upgrade at this price.

The large number of scanner manufacturers that bundle Caere OCR software with their scanners are eligible for the upgrade.

The upgrade program includes OmniPage Pro 6.0 (Windows 3.1 and 7.0 (Windows 95), which offer all the capabilities of the bundled software for extended functionality. Most notable among them are high-resolution "zooming" and preprocessing of scanned images, verification of the Page technology for the retention of the original page formatting, such as OCR training and deferred processing capabilities.

The Changing OCR Market: In the not so distant past, OCR required more and more OCR software that was often difficult to use and provided little or no customer support. These issues were frustrating and limited the use of OCR to high-volume vertical markets. The use of desktop OCR was limited to the "early adopters."

"Today, several trends are contributing to the widespread use of OCR," said Chad Kinzelberg, Caere's vice president of marketing. "The program is another major factor that will promote the use of OCR. For the occasional OCR user will find Caere software more attractive because of its ease of use and the time and money savings it provides."

Analysts following the OCR market agree that OCR use is on the rise and that the industry trends promoting its mainstream adoption:

Higher Customer Awareness: An increased number of computer users are aware of the time and money saving benefits it provides.

Higher Scanner Penetration: Scanners prices have dropped drastically in the last few years with many flatbed and edge feed scanners available for under \$500. Also, the use of small-footprint sheet-fed scanners and multifunction devices has increased.

Increased OCR Accuracy: OCR developers have developed high-accuracy OCR technology for increased output. The greatest improvement has been made on degraded and hard to read documents.

Improve Your OCR and Save Big \$\$\$

Higher Scanner Penetration:

Scanners prices have dropped drastically in the last few years with many flatbed and edge feed scanners available for under \$500. Also, the use of small-footprint sheet-fed scanners and multifunction devices has increased.



Low cost scanners entering the market have helped push OCR use to a new level.

Increased OCR Accuracy:

OCR developers have developed high-accuracy OCR technology for increased output. The greatest improvement has been made on degraded and hard to read documents.

Pricing and Availability

OmniPage Pro 7.0 (Windows and Mac) and WordScan Plus 4.0 (Windows) upgrade packages are immediately available at major resellers for an estimated street price of \$129.

The Company:

Caere Corporation, with U.S. headquarters in Los Gatos, Calif. and European headquarters, Caere GmbH, in Munich, Germany, is a leader in OCR technology and desktop document management products. Caere has recently expanded its product line of OCR

OmniPage Pro gives you almost twice the OCR accuracy with the same ease-of-use as OmniPage Limited Edition.

OmniPage Pro keeps text in its original format and layout, including graphics.

OmniPage Pro even outputs to HTML.

continued on next page

OmniPage Limited Edition

OmniPage Pro

Upgrade now to faster, more accurate OCR.

Sure, the OmniPage Limited Edition OCR that came with your scanner is good. In fact, that's why scanner makers like HP, Microtek and Agfa chose it above all others.

But if you want greater accuracy, full-throttle speed and a ton of new time-saving features, then it's time you moved up to OmniPage Pro®.

OmniPage Pro employs a new, more powerful OCR engine to recognize poor copies and degraded faxes. It integrates seamlessly with your favorite applica-

tions like Word, WordPerfect and more. It even guides you through the OCR process using its AutoOCR Toolbar. All with the simple push of a button.

What's more, you get the advantages of the world's most popular OCR software without learning an entirely new program. So make sure you're getting all the OCR power and accuracy you deserve. Visit a local computer retailer today to get your \$30 mail-in rebate coupon.



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Key Feature Comparison	OmniPage Pro	OmniPage Limited Edition
Caere's fastest and most accurate OCR engine	✓	
AutoOCR Toolbar™ for easy, one-button OCR processing	✓	
OCR Wizard to guide you through the process	✓	
Integrates with most image editors like Photoshop	✓	
OCR from within your favorite applications	✓	✓
Retains original layout	✓	

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Pipeline



Think Modular

Some top-tier computer makers are interested in a radical new design: simple, snap-together PCs that are particularly kind to nontechnical home-computer users. An estimated 60 percent of U.S. households don't own a PC, a fact that makes them prime targets for these systems.

"Just mention the word 'modular' to a PC company and you've got a meeting," says Hany Neoman, CEO of NeoSystems, which recently launched its Modular Digital Architecture (MDA). Its preproduction prototype, the NeoPC, shows how modules just 7 inches wide—for such parts as a hard disk, CD-ROM drive, floppy disk drive, modem, and TV tuner—can stack on top of a base module for easier hardware installation and upgrades. Although manufacturing costs are 5

percent higher for MDA systems than for standard PCs, the modular design could reduce support costs by simplifying upgrades.

The system's backbone is the Modular Bus—a 64-bit communication pipeline between the modules—which NeoSystems has positioned to work with future high-end components based on the high-speed Universal Serial Bus, IEEE 1394, and Advanced Graphics Port. NeoSystems designed the dual-fan cooling system to handle the next three generations of chips.

It also built MDA to work with stereos, VCRs, and other home equipment. The company is now raising the capital for its next phase—licensing the technology to PC and electronics manufacturers. It's hoping for the first systems to stack up later this year.

Every Cent Counts in Cyberspace

Loose change could be the best thing ever to happen to the Internet. New technology from Digital Equipment will soon let you buy and sell very inexpensive products over the Web, such as a newspaper or a piece of electronic art, for as little a penny.

According to Digital's CEO, Robert Palmer, the lack of a model for such small Web pur-



chases has hurt transaction processing and electronic commerce, a situation most industry watchers attribute to security concerns. Digital's technology, Millicent—named for the

value of a thousandth of a penny—is designed to process purchases of, for example, movie reviews, stock charts, or the temporary use of Java applets. InfoSeek and Reuters have already adopted Millicent.

"Dad-dy. Mom-my. Com-pu-ter."

A new study from market research firm Computer Intelligence reveals that Americans—especially those who are well-off—are buying PCs in unprecedented numbers. For the first time ever, PC penetration rose above 40 percent in 1996, with 40 million U.S. households owning computers.

The introduction and proliferation of both lower-priced and used PCs will bring more lower-income households into the market, according to the research firm. The study further reveals that American households with kids are now more likely to own a PC than not.



Online: Pentium II for You

www.comconline Should your next PC be a Pentium II system? Join us online to scope out new systems with Intel's latest processor. Measure performance any way you like with our exclusive interactive benchmark test viewers, and hone in on the system that suits you best with our interactive summary of features. Our interactive viewers will also help you pick the perfect network printer, and if you're into Web programming, you can learn more about Java as our Internet team tackles applet creation.

ALSO ON THE WEB: Be sure to check in with weekly commentators John C. Dvorak, Michael J. Miller, and Don Willmott for interesting gossip, answers to your questions, and opinions about life on the Internet. And be sure to talk back. Our discussion forums are waiting for your comments.

Adapt or Die

Based on a version of 1994 data

If you	Then you're a	% of sample
...	Glider	2%
...	Sacrificer	1%
...	Time Protractor	1%
...	Flexible	16%
...	Tech Adapter	15%
...	Passive	1%

Pipeline

Brighter Notebooks Through Recycling

With all the power that a notebook display consumes—it accounts for the machine's single biggest drain on power—you'd think it would be bright enough in all kinds of conditions, from dimly lit rooms to bright sunshine. But the bottom polarizer of the liquid-crystal display (LCD) absorbs over 50 percent of the light that the backlight generates, before that light ever reaches the screen. (The LCD is sandwiched between two polarizers.)

Now 3M has shed some light on the problem with Dual Brightness Enhancement Film, or DBEF, a material designed to recycle light that would otherwise be lost. Sitting between the backlight and the bottom polarizer, DBEF captures the light that would otherwise be absorbed and sends it back to the backlight. This process makes more light available to be trans-

mitted through the LCD.

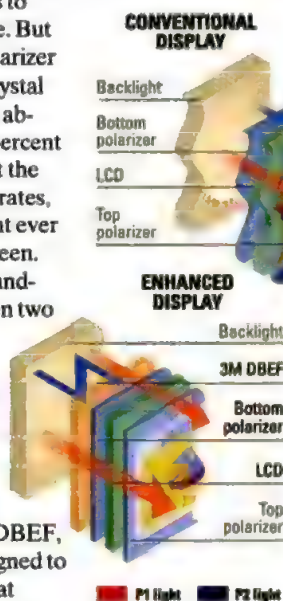
According to 3M, DBEF increases screen brightness by up to 60 percent and spreads the light over a larger viewing angle. When DBEF is used in

conjunction with 3M's Brightness Enhancement

Film—which notebook manufacturers currently use—screen brightness increases by 150 percent, according to 3M.

If manufacturers adopt the new technology, they'll be able to maximize either screen brightness or power savings, but not both. Because of the costs involved, initial plans to implement the method don't enable users themselves to flip a switch and make the choice.

In addition, 3M has big plans for DBEF beyond notebooks. Other applications include desktop monitors, display phones, TVs, and camcorders.



"Cheese of Staff"

Breakthroughs in speech recognition technology are few and far between. So-called *discrete recognition engines* require you to pause between each word, while *continuous-speech* approaches let you speak more naturally but recognize only a limited vocabulary.

Dragon Systems has combined the best of both approaches with its Dragon NaturallySpeaking, an application that marries continuous-speech recognition to a 30,000-word general vocabulary. The developers recently demonstrated NaturallySpeaking by reading stories from the front page of *The New York Times*. Aside from a few humorous blunders (the program translated "chiefs of staff" as "cheese of staff"), it yielded impressive results.



THIS ISSUE'S CONTRIBUTORS: Angela Hickman, John Morris, Carol Levin, Sebastian Rupley, and Don Willmott.



Web Acceleration

Traffic congestion on the Web is turning out to be a major headache, but developers are working fast to come up with some solutions. Compaq recently demonstrated a prototype of its near-real-time compression technique, which can send browsers images in .GIF and JPEG file formats up to three times as fast as is now possible. By reducing the amount of data transmitted, it can also help reduce congestion.

Based on so-called *wavelet compression* and developed jointly with Integrated Computing Engines (located in Waltham, Massachusetts), Compaq Acceleration Server Technology has two parts. Compression takes place at the ISP, which is equipped with a Compaq server running a card with 16 digital signal processors. A browser plug-in handles decompression. According to Compaq, the "compute power" is equivalent to that of a Cray supercomputer. "We get into the gigaflop and teraflop range," says Philip Reagan, director of engineering for Compaq's Internet group.

The World Wide Web Consortium (W3C) is tackling the problem with two other techniques. *Cascading stylesheets* reduce the data that must traverse the Internet. And *portable network graphics* allow higher compression and thus faster loading of graphics.

The Equal Opportunity Web

"Shocked" Web pages and trendy image maps are of little use to the visually impaired. But a new plan called the Web Accessibility Initiative—announced in April by the World Wide Web Consortium—outlines new guidelines and technologies that will soon make the Web more accessible.

Programs exist today that can

enlarge or alter information on-screen so it's more readable. Other tools convert Web pages into speech, print text in Braille, and even let people "type" by using a pointing device or trackball or by speaking. The initiative calls for expanding the selection of tools, as well as educating site developers as to how they can create accessible pages.

Top-Selling Retail PC Games

- 1 **Diablo** Blizzard
- 2 **Microsoft Flight Simulator** Microsoft
- 3 **Command & Conquer Red Alert** Virgin
- 4 **Myst** Broderbund
- 5 **NASCAR II** Sierra On-Line
- 6 **Quake** GT Interactive
- 7 **Tomb Raiders** Eidos
- 8 **Duke Nukem 3D Atomic** GT Interactive
- 9 **Warcraft Battle Chest** Blizzard
- 10 **Microsoft Return of Arcade** Microsoft

Source: PC Data. Data for February.

Robert
Schienberg
plans hostile
takeovers
for a living.
But at least
his monitor is
user friendly.

When Robert Schienberg plans a corporate takeover, he has a lot to think about. Profit and loss statements, price/earnings ratios, product potential, and much more.

But the one thing he doesn't have to think about is the monitor he uses to do it all on. The Hansol 700P (15.7" viewable). Its .26mm dot pitch really helps him see clearly. While its quick set-up, drop down control panel with 20 on-screen settings, modern design, reliability, and simplicity of operation, can't help but make his life a little bit easier.

So whether you're planning a takeover or a makeover, downsizing or upgrading, get the monitor that treats you like a friend.

After all, you never know when you may need one. Especially if you're Robert Schienberg.



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Microsoft
Windows 95



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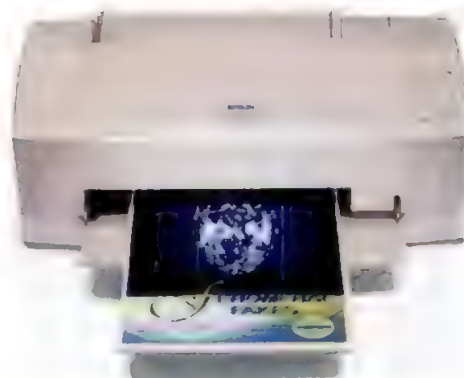
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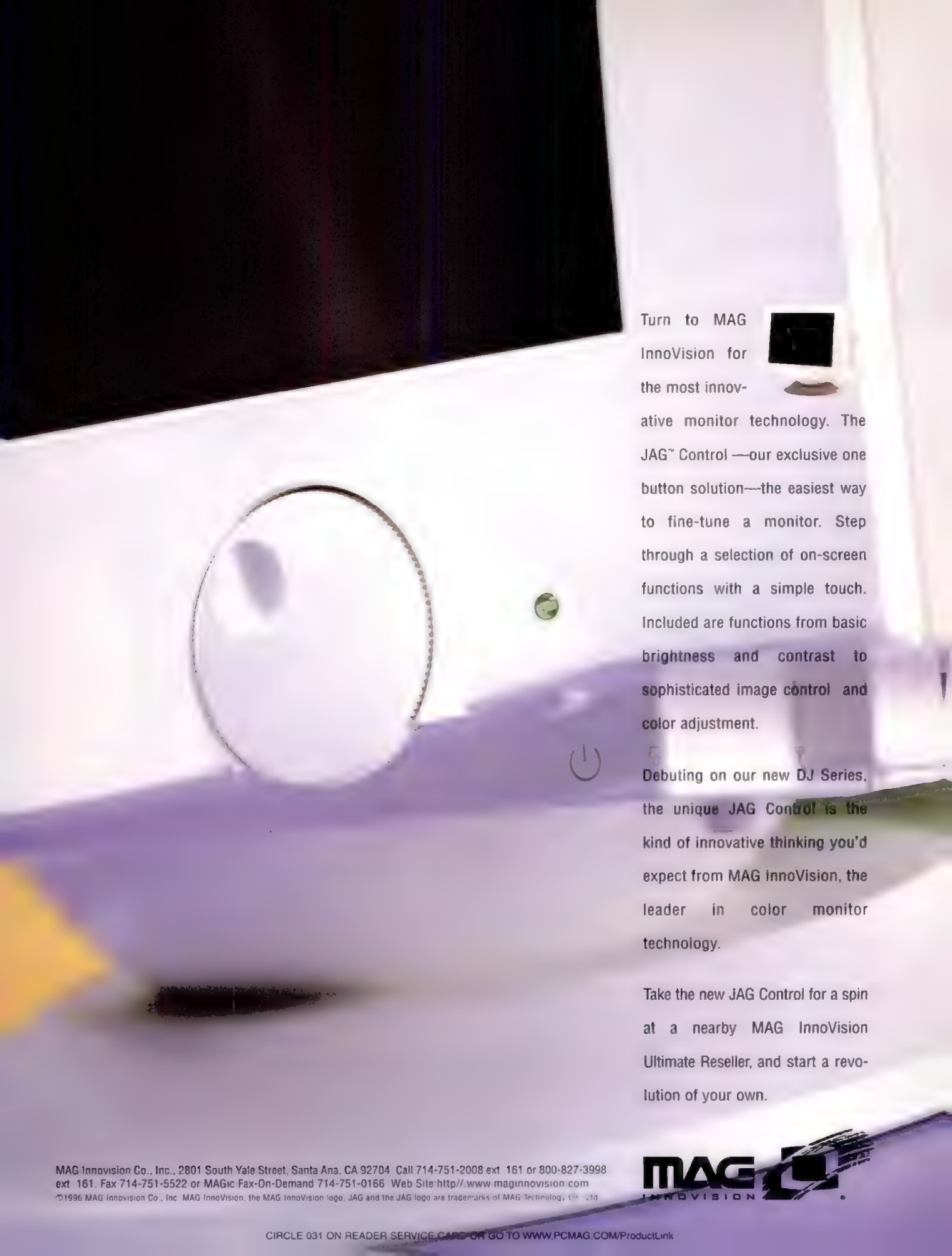
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Letters

HAPPY 15TH

I can't remember the last time I read a magazine cover to cover as I did your fifteenth-anniversary issue (March 25, 1997) and enjoyed a magazine more. The articles were in-depth, informative, and invaluable. I especially enjoyed the exhaustive coverage of emerging technologies and predictions of innovations over the next 15 years ("Looking Forward").

ALTON D. COUSINO
via the Internet

As a *PC Magazine* reader for 13 years, I was especially interested in the parade of covers in your fifteenth-anniversary issue. It's amazing how far we've come and how much farther there is to go. I remember my first PC, which had all of 256K of memory and two floppy disk drives. It cost about \$3,000 and still works.

MICHAEL LOW
via the Internet

Your fifteenth-anniversary issue was great. I thought the chronology of the computers of the past ("Looking Back"), which led to what we have today, was first-rate.

BEN JENKINS
North Canton, Ohio

As a college senior on the verge of beginning a career in the PC industry, I found the articles very exciting and useful. They really helped me to get a feel for where the industry has been and where it's headed.

SEAN BEEBE
via the Internet

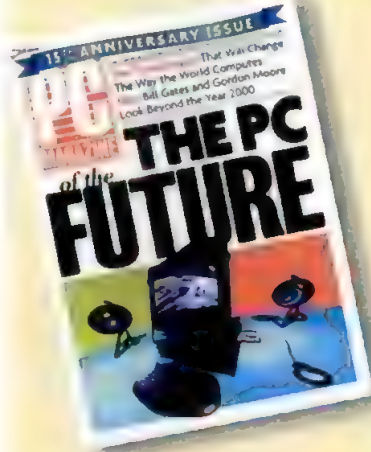
VOICING THE FUTURE

Your article "Future User Interfaces" (March 25, 1997) claims that voice recognition "is the ideal desktop application; just about all of us can speak faster than we can type." Though that's not in contention, it seems ironic that in an issue dedicated to the development of the PC we find such a glaring omission of one of its rudimentary capabilities: editing. Our minds function in fragmented thoughts and not in complete sentences. Even if our computers could understand our distinct speech patterns, how would editing be efficiently accomplished?

MATT GOLDSTEIN
via the Internet

Will someone please put a wooden stake in the concept of voice recognition computing? Can you imagine an office full of people talking to their PCs? How about having airline passengers yelling at their laptops over the cabin noise? Or how about the kids being kept awake at 2:00 A.M. by Dad talking to his computer?

JERRY TAYLOR
via the Internet



"I can't remember the last time I read a magazine cover to cover."

Everyone talks about making computers easier to use, but your editors, Bill Gates, and Gordon Moore seem to focus on speech recognition as the way to achieve this. I don't need speech recognition; I need to give requests and instructions to my computer in plain and simple English. Most of us can type well enough to do that now. If I want to do a calculation, I should be able to tell the computer "Give me the average of the gross sales for the last three years" without having to open Excel or find the files from two years ago, which are archived somewhere. Alan Cooper's philosophy came closest to this, but he's still missing the key point that we're still designing interfaces that expect the user to remember more than the computer does.

KEVIN SMITH
San Jose, California

GATES OPENS COMMENTARY

I was reading the opening paragraphs of your interview with Bill Gates in the March 25, 1997, issue when the following caught my eye: "If OS/2 had been built to be a superset of Windows then, OS/2 could have caught on earlier. And there were many points where we tried to get things moving in that direction."

I think that keeping the OS/2 API totally separate from the Windows API made OS/2 a stronger operating system. OS/2 has not succeeded to the extent that IBM had intended because IBM didn't market the product properly.

MICHAEL TYZUK
via the Internet

I found it offensive to read that Bill Gates wants to put a computer in every home. We all know that's a lie. Gates is interested in only one thing: milking the public for all it's worth. If he wants a computer in every home, why do his products cost so much?

KATHY MUMFORD
via the Internet

THE VISION THING

The debate about future PC design trends seems to miss one important point: screen resolution. As PCs merge with TVs, we're all starting to sit much closer to our cathode ray tubes. Despite reassurances to the contrary, it can't be good for anyone to stare at a bright shining light while squinting to focus on blinking lines for hours on end. What PC users need are screens with ultra-high resolution that allow the eye to focus precisely. We're not even close to such clarity yet. Such an interface between the human eye and the computer chip has to be the single most important factor that will drive continuing growth and wider use of PCs.

NICK DRUMMOND
London, England

THE CANADIAN CONNECTION

I enjoyed reading your article series "Looking Forward" (March 25, 1997). However, you demonstrate a constrained view of the world in your article "Future Home Connectivity." You claim that "so far, cable [modem] trials, flush with venture-capital cash, simply haven't been market-tested on a wide scale." In various major centers of Canada, cable companies are implementing such a service. In my hometown, Shaw Cable is rapidly deploying this technology after a large market test in Ontario. Canada, after all, has the highest percentage of Internet users in the world.

STEVE HARRIS
Calgary, Canada

The article "Future Home Connectivity" made no mention of LMDS (local multipoint distribution service, a high-frequency wireless system), which is likely to offer broadband two-way home connectivity within two to four years. The FCC auction of the high-frequency spectrum for LMDS is scheduled to take place soon.

DAVID STEINBERG
Ottawa, Canada

I found your article about future home connectivity very interesting, particularly the part about DSL modems. Unfortunately, some of your data was not up to date. I live in Calgary, Alberta. An ISP up here is already offering

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Letters

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GARRY SCHAFFEL
Calgary, Canada

LIMITING THE UNLIMITED

In Jim Seymour's column of March 25, 1997 ("Web Follies: Checking E-Mail at 2 A.M.") he complains about how he has to get up at 2:00 in the morning to check his e-mail. Hasn't he heard of any of the e-mail clients that support automatic e-mail checking? Eudora, for example, can automatically check for new e-mail after a specified amount of time. If your system is configured properly, it will even connect you to your ISP. On another note, I'm surprised at the irresponsible manner in which he presents e-mail and the Web as one entity.

ERIC MELSKI
Madison, Wisconsin

The obvious solution to the busy signals/no-dial-tone syndrome is to get your Web access from someone other than the phone company. Almost everyone who has a PC has at least one other wire coming to the house from the power company or cable TV company. Both of these industries would love to have two-way communications with more homes.

SCOTT KEMP
via the Internet

As a Webmaster and frequent online user, I found Seymour's column on Web-access problems interesting because I've never had the problems he mentions. I live on the far edge of civilization in Idaho, and the most difficulty I've ever had getting online has been an occa-

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CORRECTIONS AND AMPLIFICATIONS

In our April 8, 1997, First Looks article "Digital Darkroom" (page 45), we incorrectly referred to the DigiPhoto as the Panasonic DigiPhoto, when in fact it's made by Vivitar.

In the First Looks section of the table of contents in the issue of April 8, 1997, the a:drive is listed, but the review appeared in the issue of April 22, 1997.

In the April 8, 1997, Trends/Peripherals story "Getting Aboard the USB" (page 37), we printed a photo of the CATC USB Inspector instead of the CATC USB Andromeda.

In our March 4, 1997, review of color flatbed scanners ("Capture the Color"), we incorrectly stated that the Microtek ScanMaker III delivers 36-bit color depth scanning but passes only 24 bits of information to an image-editing package such as Adobe Photoshop. In fact, the ScanMaker III, an Editors' Choice in that roundup, delivers 36 bits both internally and externally.

The correct URL for Instant On Schedule 1.1 ("Top Shareware/Freeware Utilities," April 8, 1997, page 180) is www.developer.intel.com/ial/inston/install.htm.

sional busy signal when dialing in. But I do see the ingredients for Web collapse forming in the ether. If you charge \$20 per month for unlimited access, what is the incentive to stay off-line?

ROB HRUSKA
via the Internet

I applaud ISPs that have the courage to place reasonable restrictions on user accounts to prevent some users from monopolizing the services. The last time I checked, it was still considered a good idea to turn off the light if you weren't using the room, so why not do the same with your Internet connection?

BILL PRENTICE
via the Internet

I think that eventually the ISPs will have to return to metered service in order to escape their current bind and head off the telephone companies' moves toward metered phone-line access.

JIM VON STEIN
Grants Pass, Oregon

PUSHED AROUND

John C. Dvorak shone a dim light about pushing information ("When Push Comes to Shove," March 25, 1997) but failed to provide a solution to what he calls "crappy" products. I think the solution would be for the developers of these products either to make quality products or index their information better so someone could find it.

JIM K. KRIVOSHEIN, JR.
Stevens Point, Wisconsin

Dvorak equates push technology with having information shoved down your throat. I don't necessarily see it that way. I recently downloaded The PointCast Network, and I love it. I use it as my screen saver because I think that it is much cooler than my desktop or some star-field simulation. Now that the new version updates on its own, I have news and weather waiting for me when I get up in the

morning and when I come home from work.
RICK MANSFIELD
via the Internet

I must disagree with Dvorak. You shouldn't mix up ordering advertisements and ordering information. The push is not necessarily the tool of the advertisers, unless you consider news to be an adjunct of advertising. There are about five sites I visit regularly and, yes, I would like their information to be pushed at me.

LAURI ROKE
Tallinn, Estonia

Hurray for Dvorak's statements regarding the downside of push media. To see the end result of push technology, one has only to examine the cultural wasteland that television has become. Now the same marketing geniuses want a chance to do the same thing to the Internet. I will be relieved if it turns out that push technology is a dismal commercial flop.

JOHN SHEFF
Cambridge, Massachusetts

CLICKING KIDS

I've always enjoyed your reviews of educational and entertainment software for children. A major software design point that many vendors fall short on is the caching of mouse clicks. Watching my three- and six-year-old children use games, I can find no more annoying feature than software that "saves" the mouse clicks during a game. Many children are impatient, and even a high-end Pentium machine can take several seconds to load an image or feature in a piece of software. Hence, the kids just keep clicking until it appears. The game then remembers all the clicks and randomly takes the poor kid somewhere else when the screen appears. Make the mouse click like an elevator button. Nothing will happen any faster, but it makes you'll feel better if you keep pushing it while you are waiting.

PAUL LOURD
Greenwich, Connecticut

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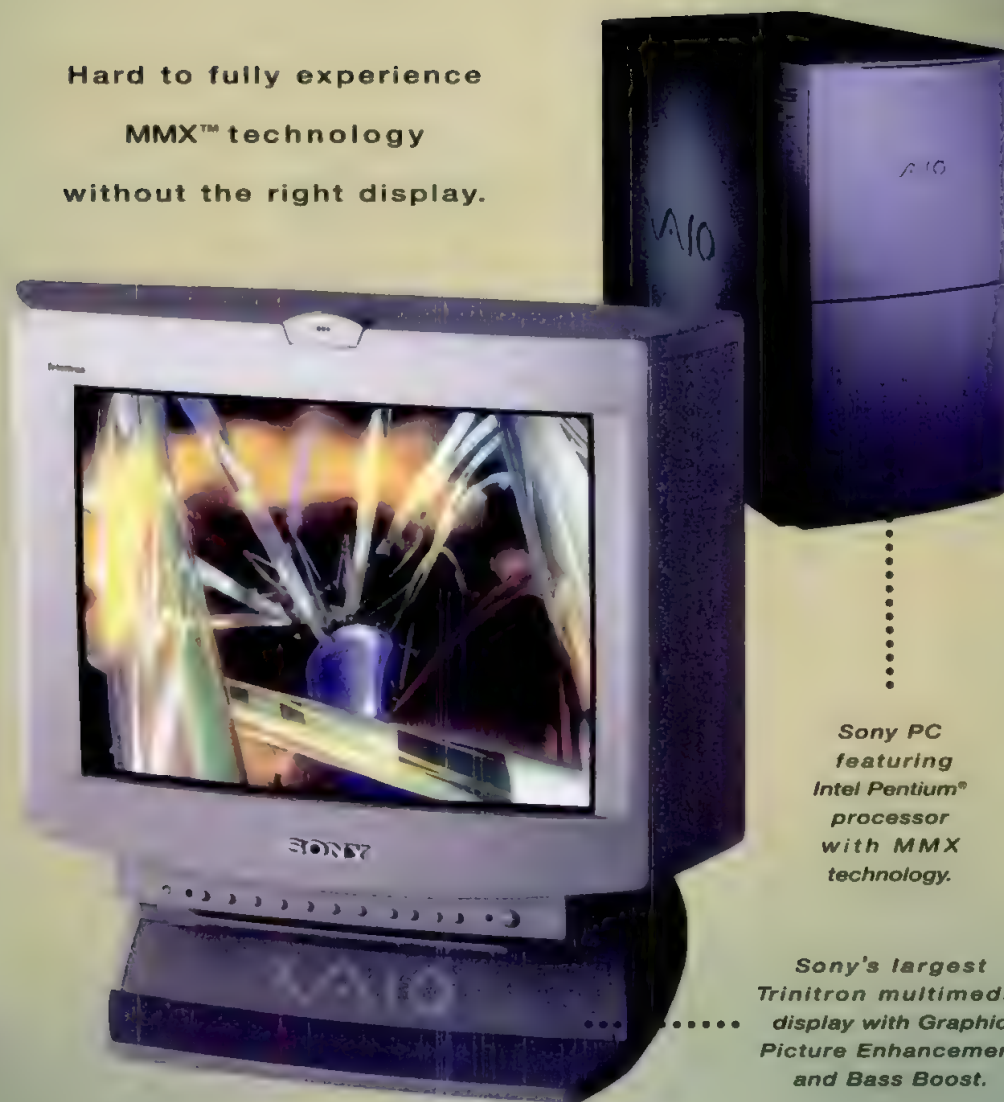
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Trends

Windows Goes Hollywood

The fall lineup heads for your PC.



Microsoft's Windows Hardware Engineering Conference (WinHEC), an annual event that affords an early glance at several major hardware and operating system developments waiting in the wings, didn't disappoint this year. Microsoft CEO Bill Gates outlined his plans to build broadcast-television features into the new versions of Windows, explained his strategy in acquiring WebTV Networks, and reaffirmed Microsoft's commitment to digital television and DVD.

New details also emerged about "zero-administration" features in the upcoming version of Windows—code-named Memphis—and Windows NT 5.0, as well as the new hardware-related initiatives these operating systems will dictate.

In addition to outlining these broad themes, Gates set some goals for the year, including eliminating the ISA bus, implementing the high-speed Universal Serial Bus (USB) and IEEE 1394 for peripherals, delivering zero-administration NetPCs (enterprise machines without hard disks), automatically upgrading drivers from Microsoft's and hardware providers' Web sites, and deploying OnNow functionality across all Windows operating systems. With regard to OnNow, Gates said, "It is ab-

solutely essential to the idea of 'information at your fingertips' that all PCs come in and out of a suspend mode immediately, so that there's no waiting during boot-up."

Demonstrations of the broadcast-television features slated for Memphis and Windows NT 5.0 featured an on-screen "electronic program guide" running on a WebTV. This guide lets you click on a selection in an interactive grid of programs scheduled for various TV channels and get a small preview screen of the show in progress. You can search for "Star Trek," for example, and receive a report of the channels that carry episodes of the show.

Microsoft expects to ship Memphis and Windows NT 5.0 with the program guide, TV remote control compatibility, and NetShow streaming video technology, which is designed to stream video over standard analog phone lines. A beta version of Memphis should be available before June.

WEBTV ACQUISITION/NC DISMISSAL

Gates gave credence to the rumors that Microsoft's purchase of WebTV Networks for \$425 million is a direct shot at makers of network computers, such as Oracle and Sun Microsystems. "We plan to build simple functionality from the PC space—such as e-mail—into low-cost WebTVs," he said, adding that the version of Windows to ship with WebTVs will be a version of Windows CE, the operating system currently found on hand-held machines. Gates also dismissed the whole notion of network computers. "As far as I can tell, 'NC' seems to stand for 'not compatible,' and I don't think people are just going to rewrite everything they want to run," he said.

Microsoft's answer to NCs (NetPCs emphasizing new zero-administration features) will ship in volume by the end of the year. Gates demonstrated zero-administration features, focusing on the notion of "centralized state." A network administrator, for example, will be able to use a server to set up customized installations of Windows throughout an enterprise. Individual desktop users won't be able to mess around with Windows settings, and the administrator will be able to control and customize users' applications and configurations. Users will then be able to call up their customized configurations from any PC on the network. The zero-administration initiative also calls for Windows to update drivers from the Web or corporate network automatically.

Gates was very upbeat about DVD (the high-capacity CD-ROM replacement) and USB, although he said that the IEEE 1394 high-speed bus technology is still "a ways out." In a mock family room set on stage at the conference, Gates demonstrated a 200-disk DVD changer linked by a 1394 connection to several peripherals. A PC displayed a tree view of all the DVD titles, including movies and music, and provided one-click launching of any title.

This panoramic tree view spanning different kinds of media, in conjunction with the on-screen electronic TV program guide, shows that entertainment driven by the Windows operating system is going to be a central focus in the upcoming Memphis release.—
Sebastian Rupley

Microsoft Entertainment PC

- Windows shell extensions for TV
- Broadcast architecture: digital satellite and TV decoders
- Supports digital audio, DVD, video, imaging
- Supports USB, IEEE 1394 external buses
- DirectX for enhanced graphics
- ActiveMovie for enhanced video

Cyberkids Get a Daily Blast

Disney unveils a Web playground.

With reports of rampant pornography and body-snatching cults on the Web, parents have been loathe to set their kids free on the Internet's cyberplayground. In the past, parents have sought help in identifying age-appropriate content, mostly through software add-ons and industry task forces charged with setting relevant standards.

The Walt Disney Company is now in a prime position to help parents in their quest. The name Disney has been synonymous with "family" for years in its many mediums, and Disney is playing that card to the hilt. The company recently introduced an online service called Daily Blast, designed to bring parent- and kid-pleasing content—such as online games, interactive stories, and up-to-the-minute news and sports—to kids ages 3 to 12, exclusively on the Microsoft Network. The service will cost \$4.95 per month but will be free to MSN subscribers.

The news is good for kids and parents, but plans to rely on subscriptions for its revenue may be a risky move for Disney. Generating a profitable Web site is a difficult task, even



BLAST OFF: Disney promises to provide games, stories, and news reports that are appropriate for kids.

for companies with big names and big wallets. Advertising is by far the most popular source of revenue, but by some accounts, services will be able to survive only on

multiple revenue sources. Robert Pittman, president and CEO of AOL Networks, is one such proponent. Presumably, America Online, Disney's competitor in cyberspace, will work towards that end.

Increasingly, kids mean big bucks online. Although the market has struggled in the past, kids are now flocking to the online services and the Internet in droves, according to market research firm Jupiter Communications. In 1996, the number of kids aged 2 to 17 using online services nearly doubled over 1995 levels to 4 million. And by 2002, that number is expected to grow to 20.2 million.—Angela Hickman



Network Printer Surprise

NETWORK PRINTERS HAVE BECOME TRUE workhorses. In testing 22 of them for this issue's feature "Print! Don't Copy," we learned a few things about maximizing performance, beginning with making sure you have all the parts you need to get the printer up and running. More than a few vendors shipped us incomplete systems for testing—some were missing the proper network adapter, others lacked the most up-to-date ROM version or printer driver, and one didn't ship with enough memory to handle some basic yet resource-hungry tasks.

First things first: We asked vendors to send us internal Ethernet 10Base-T network adapters, so that we could ensure a level playing field when using our Ethernet LAN. Most did, but one sent us an Ethernet AUI adapter and another neglected altogether to ship us an adapter—strange, since we were testing network printers.

We also asked for duplexers, mailboxes, and high-capacity paper trays, precisely the high-end features that set these printers apart from the pack. Several vendors forgot to send the special connectors and controllers needed to install them.

MEMORY TIPS

Like PCs, printers require an abundance of installed memory to run power-hungry features, such as duplexing and emulation switching, properly. Accordingly, we asked for enough memory to test those tasks. Most vendors—including Brother, Digital, Oki-data, and Xerox—provided at least double the standard RAM configuration, or twice the amount you would receive out of the box. This tells us that before buying a printer, you should ask how much memory it needs to perform optimally, as the standard

amount may not meet those needs. The Kyocera 1700 was the only printer that came with its standard RAM configuration (2MB) and could not perform duplexing.

Buyers should also pay close attention to return policies, warranties, and guarantees.

We received one printer with a bad NIC and another with a bent frame.

Only a few vendors sent the latest printer drivers. For example, we spent a day working with Hewlett-Packard's JetAdmin 4.22. To get HP's HP5siMX and Mopier machines working under Novell's NDS, we had to download JetAdmin's updated version, 4.24, and up-

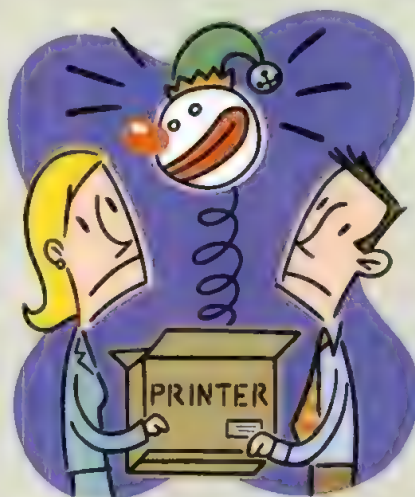
grade the firmware version on the Jet-Direct from 4.90 to 5.05. We also had to upgrade Kyocera's old printer management software, as well as upgrade its ROM chip in the printer.

Kudos to IBM and QMS. They were two of only a few companies that managed to send updated software.

NAME GAME

Setting up a printer under NetWare is relatively straightforward. But annoyingly, some vendors still require specific print server names, at least for first-time installation. Usually the required name includes a portion of the MAC address.

The smart vendors identify their print servers for you, using their own proprietary protocols; you can change the names to something more memorable via utility software. New technology on the horizon from Novell, called Novell Distributed Print Services, will enable a printer to identify itself on an IntranetWare network. The new capability will eliminate the need to set up print queues, printer objects, and print servers.—Laura Cox



Computer Kids

Microsoft and Toshiba go to class.

Last fall, Microsoft and Toshiba gave 8,000 students from kindergarten through 12th grade a Toshiba Pentium notebook loaded with Microsoft Office and full modem connectivity to the Internet, and the program is reaping an unexpected reward: perfect attendance. At inner-city public schools where truancy is a problem, motivating kids to stay in class is half the battle. The "Anytime, Anywhere Learning" project is now working in a diverse range of schools, from small rural and inner-city public schools to established private schools.

Adapting a similar program used in Australian private schools, Microsoft and Toshiba have come up with a successful model for integrating computers in schools in the United States. In most participating U.S. schools,

parents and schools split the expense, with both pitching in \$35 a month for each notebook. After leasing a system for three years, a family can buy it for \$1.

What makes this effort different from those in the past is that every kid and teacher has a notebook. The systems are used for a variety of subjects, rather than just for computer classes.

At New York City's Mott Hall, students use the notebooks about half the school day, for collaborative projects such as creating business presentations and for individual work such as rewriting papers. Since the teachers get notebooks, too, they're able to share ideas about how to use the computers for class assignments.

Another important dimension of the program is the increased level of parent involve-

ment, says Elizabeth King, general manager of K-12 education at Microsoft: In schools where security is a problem, a parent meets the kids who have notebooks at each bus stop and escorts them home. While schools vary in their implementations of the program, all have tackled serious issues related to parental support and equitable distribution of funds.

But does giving a kid a computer make a difference in academic achievement? It's too soon to tell whether reading and math scores have improved, but Microsoft is conducting a two-year nationwide quantitative evaluation of the project, and early results will be ready in the late summer. But communication arts teacher Janice Gordon doesn't need scores to know that her fifth graders at Mott Hall are more diligent, motivated, and successful.—Carol Levin



LAPTOP SCHOOL: A new program for school-children makes the grade.



JAKE KIRCHNER

Smile When You Call Me That!

You can't be a journalist without being called a few choice names from time to time. After more than two decades in the business, I thought I had heard them all—until a few weeks ago, when someone referred to me as a "content aggregator."

Actually, that wasn't so bad, given the topic of the discussion. The bad part was learning that I'm a content aggregator in an era of information "disaggregation." For those of you who are not up on your new media-speak, what this means is that I am a word-smith in a postindustrial, virtual-reality, World Wide Web world—that is, a dinosaur.

The scene was a San Francisco conference on interactive multimedia, which was convened by some of McKinsey & Co.'s world-renowned consultants. The panel in which I participated had the provocative title "Agents vs. Aggregators." The broad-ranging discussion concerned the future—if any—of traditional information publishers (aggregators) in an age of Web-based intelligent agents and push products.

Both agent software and push are attractive to anyone struggling to wade through all the information now available at the touch of a button. Many people are looking to the push products to deliver automatically the good information that we know exists, and they're looking to agents to seek out the information they can't find or don't want to take the time to track down.

For aggregators of all sorts, the question becomes: When push and agent software reach their potential and we can receive our information in personalized electronic formats, will anyone need one-size-fits all aggregations of information, such as magazines and



newspapers? And if we won't need them, why would we need editors and other "content aggregators"?

Recognizing in this question a threat to my livelihood and to my children's college fund, I quickly opined at the conference that push and agents are far from fully realized technologies. There's room for many types of information delivery for the foreseeable future, I argued. The world will need magazines—and editors—for a long time to come.

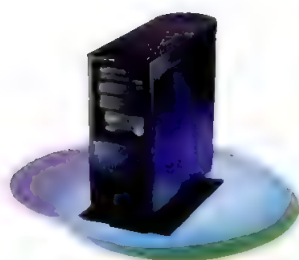
But beyond my own parochial self-interest, there's a serious point to be made. That is, it could be dangerous to rely on these methods to do more than support and supplement the traditional forms of delivery. Like all computer technologies, they can do only what we tell them to; they can find and deliver only the information we request. I can tell a computer everything I know, but I can't tell it any more. And if I can tell my computer to deliver only the information I want, I'll never learn much more than I know now.

For example, PointCast is great at delivering the sports scores that interest me and the computer industry news I need to follow. But if that's all the news I read every day, if I forsake daily newspapers and the broad range of magazines to which I turn every week, I'll soon be much less well-informed in general.

The bottom line is that in an age of information disaggregation, finding the information that you need becomes increasingly difficult. That's why the online services continue to gain subscribers even as Web sites proliferate. And that's why even as agent software and push technologies mature, we will continue to need content aggregators of all sorts, including—I hope—magazine editors and other dinosaurs.

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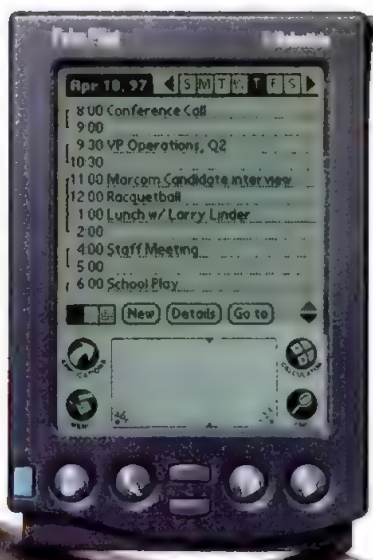
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DESKTOP PCs

The Arrival of Pentium II

After months of industry anticipation, Intel's Pentium II processor—essentially a Pentium Pro equipped with MMX technology and a revised secondary cache interface—has finally reached the mainstream corporate market. This issue's cover story, "Pentium: Part II," profiles the chip formerly code-named Klamath and reviews the first 15 systems to employ its seminal architecture.

Unfortunately, inaugural Pentium II systems from three prominent vendors were not finalized in time for our testing. Industry-mainstay IBM, longtime graphics workstation manufacturer Intergraph, and the diminutive ProGen Systems will all ship offerings soon after the processor's announcement date.

Designed for networked business users requiring superior levels of performance, the IBM PC 300XL (800-426-2968, www.pc.ibm.com) is available in both 233-

Natoma chip set and an SEC cartridge with 512K of synchronous pipeline-burst secondary cache. All models ship with 32MB of EDO RAM but support up to 384MB from three 168-pin DIMM sockets. The graphics subsystem is founded on an S3 Vision Trio Version 2 chip with 2MB of EDO VRAM, while the CD-ROM drive tops out at 16X speeds. Hard disk options include a 2.5GB or 4.2GB BusMaster EIDE and a 4.3GB Ultra SCSI.

The system's motherboard provides integrated SoundBlaster Pro-compatible audio, two USB ports, and an infrared interface. IBM preloads either Windows NT 4.0 or Windows 95 and bundles a magnanimous array of software, including Intel LANdesk Client Manager, Lotus SmartSuite 97, a remote support package, IBM AntiVirus, and a system file integrity application.

Intergraph has

Pro offering, the TD-200, which is being phased out.

Since the Pentium II provides two-way symmetric multiprocessing capabilities, the TD-225 PC is available in both single- and dual-processor versions. It supports up to 512MB of EDO RAM (the maximum for systems using the 440FX Natoma chipset) from eight DIMM slots, integrates five individual PCI slots, and offers two USB ports. For graphics, buyers can choose a Matrox Millennium card or the high-end Intense 3D Pro 1000 and the midrange Intense 3D 100 graphics cards. EIDE hard disk options range from 1.7GB to 5.2GB models, while SCSI options can take you as high as 9GB. A 12X CD-ROM is standard, but a user can substitute a CD-R drive. An SRS 3-D wavetable sound card is accompanied by either two HD-20 Koss speakers or Intergraph's multimedia keyboard (which integrates its own speakers). The TD-225 PC also ships with Intergraph's new InterSite management package, a hardware- and software-based tool modeled on the DMI (Desktop Management Interface) standard. InterSite alerts IS managers to chassis intrusion, temperature changes, and power abnormalities while monitoring system drivers.

A single-processor 233-MHz TD-225 PC with 16MB of RAM, a 1.7GB hard disk, and preloaded Windows 95 starts at \$1,985. A dual-processor 233-MHz system with 32MB of memory, a 1.7GB hard disk, and Windows NT begins at \$3,283.

ProGen Systems (800-848-1353, www.progen.com), a division of the wholesale hardware peripherals vendor ProGen Technology, is marketing its Polaris 233 Pentium II design toward power users in

both corporations and small businesses. The 233-MHz Polaris ships standard with 64MB of EDO RAM and can accommodate up to 1GB of total memory, although the system's 440FX chipset supports only 512MB. Priced at \$3,249, the Polaris features a



5.1GB Maxtor EIDE hard disk and a U.S. Robotics 33.6-Kbps fax modem. This high-end multimedia system also has a Diamond Stealth 3D 3000 video graphics board with 4MB of VRAM, a Hitachi 16X IDE CD-ROM drive, and a 32-bit Creative Labs AWE audio subsystem. The latter is augmented by a subwoofer, two 80-watt speakers, and a gooseneck standup microphone. A Panasonic S17 PnP monitor is included as well. For a system with a 4.3GB SCSI drive, 128MB of memory, and a 12X SCSI CD-ROM, pricing will start at \$3,999; a version with a 5.1GB EIDE drive, 128MB of memory, and a Panasonic 24X EIDE CD-ROM costs \$3,699.

Unicent Technologies (formerly known as PC Imposters; 800-659-5350; www.unicent.com) has also introduced a new line of Pentium II PCs for business and power users. The **Titana II** series, available in both 233- and 266-MHz configurations, is packed with such features as 32MB of EDO RAM, 6.5GB hard disks, and 4MB Matrox Millennium graphics boards. Pricing for the 233-MHz system with a 17-inch monitor starts at \$2,899; the 266-MHz system starts at \$3,099. For another \$549, you can add a Toshiba DVD-ROM drive, complete with MPEG-2 board.—Cade Metz



TAKE II: Pentium II Systems from ProGen (above) and Intergraph (upper right).

and 266-MHz flavors. With an integrated Intel 10/100 Ethernet that offers Wake-On-LAN technology, a manageability chip that monitors system performance, and TME 10 NetFinity software to monitor thermals and the like on the client side system, the 300XL eases the demands on IS managers at installation and during everyday usage.

Like every inaugural Pentium II, the 300XL uses Intel's 440FX

announced the **TD-225** PC, which is also available in both 233- and 266-MHz versions. This value-oriented PC will be sold through resellers as well as Intergraph's direct sales channel (800-692-0242, www.intergraph.com/express). Suitable for the corporate office, the TD-225 will also satisfy the creative or technical professional who relies on CAD and animation applications. The TD-225 replaces Intergraph's 200-MHz Pentium

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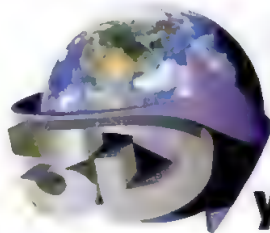
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Trends Software

TIME-TRACKING SOFTWARE

Maximizing Your Minutes

If you run a business that requires you to track billable hours for clients, or if you just want to structure your time at work more efficiently so you'll know how your day disappeared, there's something for you in the world of tracking software. The products in this roundup, all of which run under Windows 95 and Windows NT, try to streamline things so tracking your time won't become a chore unto itself.

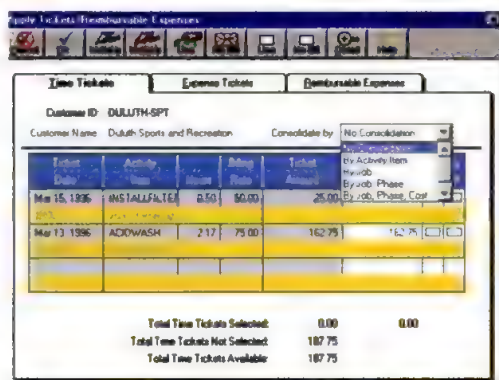
TimeKeeper for Windows, Version 3.61, from WSG (212-675-2500, www.wsg.com), helps managers and staff understand how they spend their time by closely examining how they use it. With simple online time sheets, the \$195 TimeKeeper lets you enter time and expense information and then helps you figure out how to be more efficient. The product tracks charges and enables businesses to plan, monitor, and calculate costs.

Timeslips Corp. (800-285-0999, www.timeslips.com) has released **TimeSheet Professional, Version 5.0**, a \$199.95 package that organizes workgroups, manages existing resources, updates project files, and tracks employees' time and expenses. You can now enter the time you spend at work by using a spreadsheet format, a day-at-a-time format, or the new Time Card view, which resembles a paper time sheet and lets you enter stop or start times.

TimeSheet prevents users from editing previously entered information and requires a supervisor's intervention for employee modification. In addition, this version of TimeSheet (which also runs on Windows 3.x) integrates seamlessly with Timeslips Deluxe, the leader in time-and-billing software.

Carpe Diem, Version 2.0 (\$3,000

for a ten-user license), from ProSoft Corp. (800-477-6763, www.pscorp.com), lets you create electronic time sheets and expense



TIME AND MORE: Peachtree Complete Accounting Plus Time & Billing.

reports that you can export into virtually any project management, database, or time-and-billing program. The Carpe Diem system has four separate modules: CD-Tracker, which simply tracks your time; CDEntry, which assists those who handle the administrative minutiae of time-tracking; CD-Mobile, which synchronizes time-tracking data with the "home base" while users are on the road; and CDAdmin, the system administration utility. Carpe Diem runs on Windows 3.1, Windows 95, or Windows NT 3.51 or later.

Unitime for Windows (\$795 for 75 users or less), from Unitime Systems (800-689-5487; www.unitime.com), tracks an employee's time on the job by working in conjunction with an automated timeclock to prevent employees from punching in for other employees. Some of Unitime's handy features include a built-in report writer and a spreadsheet for time scheduling. Unitime, which runs on DOS as well as Windows 3.x, Windows 95, or Windows NT 3.51 or later, also integrates with Best Software's Abra Human Resource Software and Abra Pay.

HourTrack 97 (\$99 for ten users), from Vitrix (800-561-6366, www.vitrix.com), comes with over 20

time reports that are ideal for human resources professionals, including reports for total hours worked, time off, paycheck distribution, and more. You can export these reports into Microsoft Excel and Access or into HTML. The package, which runs on Windows 95 and Windows NT 4.0, supports such hardware options as a fingerprint-verification system and magnetic badge-swiping.

Quality Software Solutions (888-423-5757, www.tclock.com) has introduced Version 1.0.25 of **TimeClock Lyte for Windows 95**, a shareware title available for a 30-day trial period (afterwards, it costs \$17.99 for unlimited use). TimeClock Lyte calculates the total hours each employee works, and it allows managers to modify transactions and print reports. A DOS version, called TimeClock, is available for \$199.

Peachtree Software (800-428-9973, www.peachtree.com) is now offering a version of its popular Peachtree Complete Accounting package that integrates time-and-billing modules. **Peachtree Complete Accounting Plus Time & Billing** (\$250 street) is targeted toward service and vertical markets. You can enter the time you spent working, and the information can then be used to create invoices, generate reports, or run a payroll. There's also expense tracking, which is linked to the relevant customer invoice, and four billing-status options.

If you need to track the time you spend online, Parsons Technology (888-883-0791, www.parsonstech.com) has a simple but useful solution. The \$19 **Online Stopwatch** monitors the amount of time you spend using online services such as America Online and CompuServe, Internet browsers such as Netscape Navigator and Microsoft Internet Explorer, and BBSs.—Yvonne Koulouthros

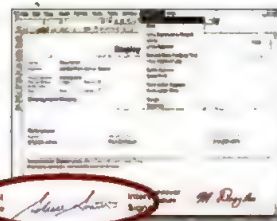
ELECTRONIC SIGNATURES

John Hancock Goes Digital

Put your pens away. With Silanis Technology's (888-745-2647 www.silanis.com) **ApproveIT for Office, Version 3.0** (\$149 per seat), Microsoft Office documents and spreadsheets can be handled, distributed, and stored in a more cost-efficient manner, thanks to ApproveIT's electronic signature software. ApproveIT accepts and prints real handwritten signatures for visual authentication and allows multiple approvals for each document. It also ties together the signature and document by embedding the approval information into the document.

InkTools (\$499), from Communication Intelligence Corp. (800-

888-8242, www.cic.com), is a similar software suite that incorporates electronic ink-based and signature-based security into a wide variety of form-based and access control applications. InkTools provides both 16- and 32-bit DLLs and includes an API that supports



STAMP OF APPROVAL: Silanis' ApproveIT for Office 3.0.

Windows for Pen Computing applications as well as a generic Windows API that doesn't use the pen extensions.

Meanwhile, Advanced Recognition Technologies (818-678-3999, www.artcomp.com) offers electronic signature capability for Windows CE, Windows 95, and Windows NT through the \$29.95 **smARTscribble**, which is included in its \$69.95 smARTwriter Plus package.—Brett Krasnov

Trends Peripherals

NETWORK PRINTERS

Perfect Copies Every Time

Forget the paperless office: The next innovation to hit the workplace may take the unassuming shape of your network printer. Many units in the 24- to 40-pages-per-minute (ppm) range now let you create multiple originals with ease, and a handful offer the ability to fax, copy, and scan as well.

A new breed of network printers—dubbed “mopiers”—makes it feasible to send a multiple-copy job to the printer that won't clog the network or tax printer memory. Instead of spooling each copy to printer memory individually, mopiers spool the job only once, so it appears to the network and the printer as a single-copy request.

Remote faxing, another innovative feature cropping up in network printers, allows you to fax directly to another fax-capable printer, which then prints your fax as an original document.

Other modular design schemes blur the line between printers and copiers. Referred to as multifunction devices, these units are essentially walk-up copiers that you can add features to as needed, such as network printing, faxing, and even scanning.

Our roundup “Print! Don't Copy,” which appears in this issue, reviews 22 of the latest network printer models (ranging from 12 to 40 ppm) as well as Canon's multifunction device, the GP-200F. Four models, however, weren't completed in time for our testing.

Lexmark International's (800-539-6275, www.lexmark.com) 12-ppm **Optra S 1250** and 16-ppm **Optra S 1650** each received an Editors' Choice award for their fine

print quality, robust modular stackable features, and speed. Rounding out the line is the 24-ppm **Optra S 2450** (\$2,699). Like the other two Optra models, the Optra S 2450's sleek design lets you add additional paper trays or



a duplexer with ease. The unit also includes MarkVision, Lexmark's excellent printer management software.

Dataproduct Corp. (800-980-0374, www.dpc.com) is gunning to replace both your copier and

fax machine with its **Digital Document Server (DDS)** line. The 24-ppm, 600-dots-per-inch (dpi) **DDS 24** prints multiple originals in either single-sided or duplex mode; it also collates pages, staples the job, and alerts the user when the job is complete. This \$10,500 printer's built-in 14.4-Kbps fax modem lets you send a job to a remote site, where it can be printed on another DDS printer as a 600-dpi original

or received by a fax machine as a T.30 fax. Other unique features include the ability to fax in duplex mode, which cuts paper usage in half, and multiposition stapling, which lets you choose the corner you want stapled.

Also jumping on the multifunction device bandwagon is Xerox Corp. (800-275-9376, www.xerox.com), which offers the **Document Centre** family of printers. First to market are the 20-ppm **DC 220** (\$8,600) and the 30-ppm **DC 230** (\$10,500); both are 400-dpi copiers with fax and scan capability. This fall, Xerox will roll out network versions of the DC 220 and DC 230 that deliver 600-dpi network-printing



SLEEK MACHINE:
Lexmark's
Optra S 2450.

capability. Xerox will also introduce 40- and 65-ppm units; network versions should be available in 1998.

Minolta Corp. (800-264-6658, www.minoltaprinters.com), a longtime builder of printer engines for Lexmark, Epson, and Mannesman Tally, is readying its first branded printer line for small and midsized businesses: the 12-ppm **PageWorks 12** (\$1,000 street) and the 20-ppm **PageWorks 20** (\$1,500 street). These prices are extremely competitive, but they don't include the network interface card (under \$400 street) or a duplexer (under \$480 street).

—Toni Kistner

CD-RECORDABLE DRIVES

Write It Again, Sam

Even though CD-R drives and premastering software are new to the mainstream peripheral marketplace, the technology behind them continues to evolve rapidly. The newest innovation is CD-RW, or rewritable CD-R, which takes CD-R to the next level.

Traditional premastering software limits you to writing full tracks of data in a single session only; there is no way to accumulate new data to the disk over time. Variable packet-writing software—which is becoming widely supported—is a vast improvement, because it lets you write data by the file and in multiple sessions. This method is ideal for creating password-protected data



REWRITE:
The Ricoh MP6200S.

backup disks as well as ISO 9660 disks, which are readable in any CD-ROM drive.

Using variable packet-writing software and special rewritable media, CD-RW drives can rewrite data up to 1,000 times. CD-RW is ideal for backup, temporary storage of in-process documents, or data interchange. CD-RW disks won't play in existing CD-ROM

drives, but CD-RW drives let you create CD-R disks, which will. Also, CD-RW disks will play in DVD drives, whereas ordinary CD-R disks will not.

Ricoh Corp. (800-955-3453, www.ricoh.com) is first out of the gate with a combination CD-R/CD-RW drive, the \$599 **MP6200S**. Based on Ricoh's RO-1420C, this 2X-write/6X-read drive uses a SCSI interface and supports track-at-once, disc-at-once, multisession, and packet-writing modes. Ricoh's CD-RW media cost \$25 (street) each.

From Plextor (408-980-1838, www.plextor.com) comes the **12/20PleX** (\$269 internal, \$359 external), the first CD-ROM drive to support CD-RW media. The drive is fast, utilizing CAV (Constant Angular Velocity) technology to achieve speeds of 12X on the inner tracks and 20X on the outer. —TK

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WEB-AUTHORING TOOLS

Your First Web Page

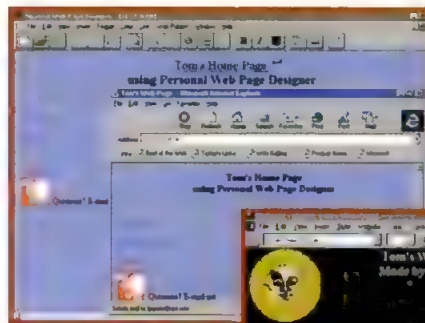
Store shelves are filled with all sorts of advanced HTML editors, but if you're on the go, learning HTML is probably not something you want to do during your spare time. Any of these three programs can help you get your Web page up and running without learning a single HTML tag.

Advanced users can publish on the Web with Group 32 Corp.'s \$39.95 **Webwizz** (800-553-0400, www.group32.com), but novices will appreciate the product's optional, fill-in-the-blanks method. The Homepage Expert wizard helps you choose a custom background style and button styles. It also lets you select the number of supplemental pages you want to link from the home page as well as their titles and content. You

can add precooked Java effects, sound clips, and graphics to your page, and you can polish your work with scrollable frames and drop shadows.

When you're through designing, Webwizz displays your home page within the program's own editor while project notes guide you through the editing process. The package includes a utility that uploads your page to the Web once you're finished.

The \$49.95 WYSIWYG **Personal WebPage Designer**, from Pacifica Internet Authoring Tools (800-755-9036, www.pacificasoftware.com), comes with print documentation that explains the basics of the Internet and Web-page creation, helps you plan your page, and guides you through making a test



GET ON THE WEB:
WYSIWYG tools
from Pacifica (top
left) and
Group32.

company's site. Designed for both intermediate and novice users, this tool combines the benefits of a WYSIWYG editor with a text editor. You

page. In your actual home page, you can easily create links, insert and resize graphics, and protect your Web page with a password. Pacifica offers users 2MB of free storage on their servers for one year.

Namo Interactive's **WebEditor** (www.namo.co.kr/eng_index.html) is a \$59 shareware authoring tool available for download from the

can add JavaScript, VBScript, and Java applets to your pages with relative ease. WebEditor is a compact solution for users who don't want the large footprints of many authoring tools.—Tom Ponzo

BUSINESS APPLICATIONS

Bring In the Web

With its CenterStage technology, OnDisplay (800-508-8800, www.ondisplay.com) wants to simplify the integration of Web-based data into traditional business applications. CenterStage Developer (\$995 per developer) has two basic components: the PageAgent Builder and the PageAgent Engine. The

PageAgent Builder lets you construct JavaScript-based PageAgents that define the location and structure of the information you wish to extract. The PageAgent Engine then dynamically retrieves this information (while preserving the HTML source code that defines its

structure) and integrates it into the application of your choice. Information contained in an HTML table, for example, can be retrieved in its tabular form and inserted into a spreadsheet. End users view the data via

JAVA-SCRIPT MAGIC: OnDisplay's PageAgent Builder.

CenterStage Web Analyst software (\$39.95 per user). OnDisplay also offers **CenterStage Server** (starting at \$9,995), a version of the PageAgent Engine that can support multiple users and simultaneous requests, and **CenterStage Desktop** (\$295 per user), which includes Web Analyst, PageAgent Builder, and PageAgent Engine. CenterStage requires Windows 95 or Windows NT and either Netscape Navigator or Microsoft Internet Explorer 3.0 or greater.—Nancy Sirapyan

WEB SITE

Of Books and Culture

Just because you're an old standard doesn't mean you can't keep up with the times.

The *Atlantic Monthly* (800-854-7700, www.theatlantic.com), a magazine of politics and culture founded in 1857 by Ralph Waldo Emerson and friends, has just relaunched its Web site. Now the site offers the entire text of the print magazine as well as an assortment of weekly and monthly online features. Less "newsy" and more interactive than Microsoft's Slate, *The Atlantic* returns with a snazzier user interface, new online-only columns, interviews and reviews, and more forums in which to debate everything from marijuana policy to orange marmalade. You can exchange e-mail with famous authors and political figures, play word games, write limericks, and

vent your spleen in various discussion settings and contests. But beware: Contest submissions may be posted publicly for the amusement of others.

Appealing to the same set of literati is the recently launched Books section on *The New York Times* Web site (800-698-4637, www.nytimes.com/books). For the first time, all of the latest re-



views from the Sunday Times' venerable Book Review section are reprinted on the Web, along with a comprehensive archive of book reviews dating back to 1980. Visitors can also participate in special interactive discussion forums, scroll through online-only author profiles, and read daily features and actual excerpts from books that have been reviewed.—Josh Levy



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Modem	33.6	33.6	33.6	33.6
CD-ROM	10X	10X	10X	10X
Video Capture	Yes	Yes	Yes	Yes
Video Support	Yes	Yes	Yes	Yes
Battery	Lithium Ion	Lithium Ion	Lithium Ion	Lithium Ion
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TRAVEL PRO 2010CX



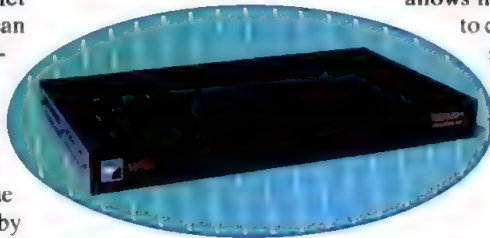
VIRTUAL NETWORKS

Private Connections

Connecting remote users or sites to your LAN no longer requires the costly investment of a remote access server or a leased line. Many companies are now taking advantage of what the Internet and local Internet service providers (ISPs) can provide to create virtual private networks (VPNs) that connect road warriors and remote campuses.

To insure privacy, the VPN solutions use a technique known as tunneling, whereby data in the IP packet is encrypted, sent over the Internet, and decrypted once it reaches the desired location. Two vendors currently shipping solutions are VPNET Technologies (888-876-3888, www.vpnet.com) and Signal 9 Solutions (613-599-9010, www.signal9.com).

VPNET Technologies offers a trio of VPN products. On the LAN side, there is the \$3,995 **VSU-1000 VPN Service Unit**. This device sits in front of your router and authenticates remote



users via an exchange of digital certificates. In addition, it can support throughput from 56 Kbps to 2.048 Mbps.

The \$99 **VPNremote Client Software for Windows 95** provides the same 56-bit DES and Triple

DES encryption, authentication, and key management as the VSU-1000. Currently, it supports all of the working IPsec standards from the Internet Engineering Task Force (IETF).

To manage the client and server connections, VPNET presents the \$3,995 Java-based **VPNmanager Tool Suite**, which allows network administrators to configure and check the status of their local VSU-1000 units as well as the status of remote sites and dial-in users.

Unlike VPNET's VSU-1000, Signal 9's LAN-side product, **ConSeal Tunnel**, sits either parallel to or behind the network firewall. You have a choice between a low-bandwidth solution (starting at \$995 per end point), which supports speeds

up to 256 Kbps and runs on an Intel 486/33, or a high-bandwidth solution, which supports up to 6 Mbps on an Intel Pentium Pro 200-MHz machine.

Both server solutions use multiple authentication techniques, digital signatures, and the Challenge Handshake Authentication Protocol (CHAP) to ensure that only authorized connections can be made. You have the choice of using either DES, Triple DES, or Blowfish encryption schemes. Each key is private—there is no public key server that might be vulnerable to hacking. ConSeal Tunnel can also help you improve security by tumbling the encryption keys and inserting random noise between the IP packets.

For the remote user, Signal 9 offers its \$99 **ConSeal PC**, which allows a user to connect to a ConSeal Tunnel. ConSeal PC is available for Windows 95, Windows NT 3.5, and Windows NT 4.0.—Robert Daly

VIRTUAL PRIVACY: The VSU-1000 lets users make secure connections over the Internet.

HIGH-SPEED NETWORKING

Speed and Symmetry

Fast modems are all the rage these days. Between ever-expanding Internet use and the higher bandwidth demands of multimedia, there will always be a need for reliable, affordable connections.

The next step up from standard modems is ISDN, a pricey proposition that's rapidly falling prey to the new, faster breed of 56-Kbps modems. Beyond that is T1, which provides speeds starting at 1 Mbps—for a price. Filling the gap between ISDN and T1 is Digital Subscriber Line (DSL), which up until now has been available only on a trial basis.

Multiple flavors of DSL are currently being kicked around, promising throughput of up to 8 Mbps. Copper Mountain Networks (888-267-7374, www.coppermountain.com) is hoping to bring DSL to the end user in the form of Symmetric DSL (SDSL). The company's \$599

Red Rocket 201-10x SDSL access router is the first in a series of products that fill in the speed gap from 160 Kbps to 1.168 Mbps—all over existing copper wire.

At the other end of the line is Copper Mountain's **CopperEdge 200** fast-packet DSL multiplexer, a central-office platform that offers multispeed DSL for under \$350 per port. The CopperEdge 200 connects to a wide range of WAN backbones, including T1, 10/100Base-T, and OC-3.

The Red Rocket 201-10x has a footprint that's 6.5

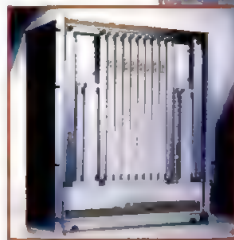
inches by 9.5 inches. The unit can be mounted on the wall to take up less real estate; the slanted face allows for easy viewing of the status lights from the top or the front. In the back of the unit is a standard RJ-45 10Base-T jack and a POTS (plain old telephone service) port. The Red Rocket

201-10x can reach speeds of up to 416 Kbps. Its sibling, the \$649 **Red Rocket 201-30x**, races ahead to 1.168 Mbps.

Once the Red Rocket 201-10x is plugged in, it contacts the nearest CopperEdge 200 and configures itself automatically. From then on, your phone line becomes a virtual

extension of a physical LAN—no busy signals or connection charges come with DSL.

SDSL is not the solution for everyone, though. The Red Rocket requires you to have an Ethernet adapter card in your PC. This will not be an issue in most business and small-office environments, however, because they should already be using Ethernet networks.—David R. Lambert



THE ROCKET'S RED GLARE:

A Red Rocket router can connect you at 1 Mbps, provided there's a CopperEdge 200 it can connect to.



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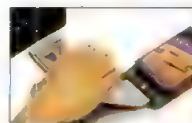
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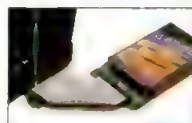
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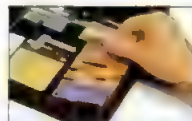
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First Looks



Clockwise from top:
Lexmark 7000, HP PhotoSmart, Alps
Masterpiece MD-2300, Canon BJC-4550,
Epson Stylus Photo

Photo Finish

Five photo-quality printers turn PC-based images into stunning prints.—By Bruce Brown

Color ink jet printers have been on a winning roll that surely won't end anytime soon. After killing off the dot-matrix printer market and wounding the personal laser business with great text printing and terrific color graphics printing, the newest ink jets are primed for a new target: the high-quality color-printer market, specifically for printing photographic images.

High resolutions, special photographic inks and papers, and friendlier software for collecting, editing, and printing photographs all help. If you thought last year's ink jets were impressive (and we sure did), wait until you see what these new models can do with scanned photos, digital camera shots, and images downloaded from the Internet.

All of the major ink jet printer vendors will introduce new models this year (in some cases, they'll feature multiple printers

for different market segments). Look for new entry-level printers, mainstream home/SOHO printers, high-resolution graphics printers, and printers specifically targeted at photographic applications. The great news is that most of these devices are priced under \$500, including one that does a great job printing on 11- by 17-inch paper.

THE NEW MODELS

For this roundup, we asked vendors for their newest, best-quality high-resolution ink jet printers intended for home, small-office, or single-user desktop applications. Although some vendors had more than one new printer, we asked for the one most appropriate for printing photographs. We ended up with a fine mix of printers, each with its own special attributes and abilities.

The Alps Masterpiece MD-2300 takes a different path to printing from the others, using

sets of four ribbons and a heated print head rather than tiny jets of ink to create gorgeous output.

The Canon BJC-4550 is a general-purpose printer that can use Canon's Photo Ink cartridge for photo-quality output. It can also print on tabloid-size, 11- by 17-inch paper.

Epson's new Stylus Photo is specifically intended for printing photographs, and it can do a worthy job on plain paper as well.

Hewlett-Packard's PhotoSmart Printer is one element in a three-part system (the others are a scanner and a digital camera), all designed to produce quality photographic output using your PC.

Lexmark's new 7000 Color Jetprinter is a speedy printer with excellent black text and monochrome graphic output. It's also very adept at color graphic and photographic-image printing.

SELECT TOOLS WITH CARE

Before you purchase any of these printers, you should decide what you're going to do with them. The Alps Masterpiece MD-2300 is the vendors' sole model in this printer category. Canon, Epson,

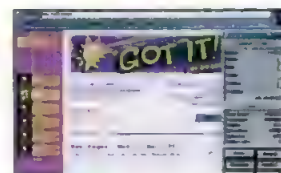
INSIDE



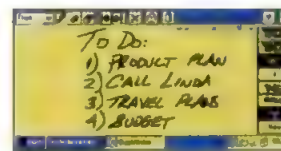
THE BIG SCREEN: Fujitsu General's Plasmavision 42 will broaden your viewing experience. See page 54.



HELP WANTED: Click here for a better career. See page 70 for reviews of job-search Web sites.



GETTING IT: Got It!, from Go Ahead, is an intelligent way to cache Web pages. For the review, see page 62.



POCKETWARE: Symantec, CIC, and Landware deliver the newest applications for Windows CE. See page 73.

More Products Reviewed

Arcadia AR3.1	58
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CaptiveX, Version 2	62
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WebCompass 2.0	62
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First Looks



Alps Masterpiece MD-2300

Street price: \$750

Alps Electric Inc., San Jose, CA

800-825-2577, 408-432-6000

www.alpsusa.com

Circle 415 on reader service card.

HP, and Lexmark all offer a range of models for various levels of general-purpose printing.

The photocentric printers from Epson and HP both do a tremendous job of printing photographs, but if most of your printing jobs are text—with some graphics printing and occasional photo-image printing—consider one of the general-purpose printers in these vendors' lines (for example, the Epson Color Stylus 800 or the HP DeskJet 694C).

If you choose a photocentric printer for general-purpose print duties, you may sacrifice some quality in nonphoto printing. You may also find that these printers are pricier, slower, and more expensive to operate in general than less task-specific models.

The Canon BJC-4550 and Lexmark 7000 Color Jetprinter are general-purpose printers. Although each drops back a bit in photographic print-image quality compared with the Epson and

HP, they do a fine job overall, with print quality spread evenly among text, graphics, and photographic printing.

CONSIDER THE SOURCE...

Typically, you'll print images from one of four common image sources: scanned images, downloaded files, photo CD files purchased or created by your film processor, and digital camera shots. Since printer quality now is quite high, the quality of the file you print from is the crucial element.

Consumer-level digital cameras (usually for less than \$1,000, with many less than \$500) give you the greatest freedom. Used like a conventional camera, the digital camera takes pictures and stores them digitally using internal memory or removable flash RAM cards.

After downloading to a PC, the shots are ready for printing; unfortunately, current consumer-level digital cameras are relatively low-resolution devices. This means that photographs printed from digital-camera images won't have the high resolution,

rich colors, and fine details of photos produced by film-based cameras.

Using photo prints (scanned at 300 dpi) as your image source will produce quality output on one of these ink jets. Photo CDs with commercial photographs—or your own shots processed in Photo CD format—can be loaded at different resolutions depending on the size of the output image you want to print. Files downloaded from the Internet or online services in JPG or GIF format also print well, but final print quality depends largely on the resolution of the original scanned image.

... AND THE CONSUMABLES

Low-end ink jet printers cost under \$200, and a wide selection of better-quality, general-purpose devices are available from \$250 to about \$500. Photocentric ink jets are priced around \$500, but that's just the start of your expense. For top-quality output, ink and paper costs must also be calculated.

The two printers that produced the best photo output—the Epson and the HP—don't have special photo ink cartridges. Since their central design feature is photo printing, their cartridges are specifically tuned for photo

printing, because each one uses six colors in the process.

The Epson Stylus Photo is rated at \$1 per page for 100 percent, 8.5-by-11-inch printing with 1-inch margins. It also does a fine job draft printing on plain paper (at 1 or 2 cents a sheet). But for top-quality images, you'll want to use glossy photographic print paper, which costs about \$1 per page.

HP doesn't rate ink cost separately but estimates a \$2-per-page cost, including ink and glossy photo paper for 8.5-by-11-inch prints. You have to use HP-specific photo paper for photo-mode printing with the PhotoSmart. By contrast, with Epson's Stylus Photo, you can use the vendor's 720-dpi paper for very sharp output at a lower cost (roughly 7.5 cents per sheet).

If photos are your focus, look closely at the two printers here that earned an Editors' Choice: the Epson Stylus Photo and the HP PhotoSmart Printer. The Alps Masterpiece MD-2300 is also a good choice, even though this printer is slower and more expensive than the others. The general-purpose Canon and Lexmark printers can produce large-format output as well as exceptional monochrome prints. If these five devices are any indica-

PERFORMANCE TESTS

Photo Printers



We measured text-printing speed by printing a five-page Microsoft Word 97 document with a variety of typefaces, characteristics, and sizes. To test speed in printing mixed text, graphics, and gray-scale monochrome elements, we printed a single-page newsletter using

Microsoft Publisher for Windows 95. We also used Publisher to time how long it took to print a page with five-color photographic images. In all cases, we used normal paper if allowed by the printer driver. In photo mode the Alps Masterpiece MD-2300 requires photographic paper.

	5-Page Text Document Minutes:seconds	Full-Page Newsletter, Mono Minutes:seconds	Full-Page Photo, Color Minutes:seconds
Alps Masterpiece MD-2300	6:17	1:28	10:36
Canon BJC-4550	3:08	1:21	3:45
Epson Stylus Photo	6:06	2:02	3:50
HP PhotoSmart Photo Printer	5:35	2:39	3:45
Lexmark 7000 Color Jetprinter	1:52	0:35	7:27
Epson Stylus Color 500*	2:17	2:01	1:58

* Reported for comparison (360 dpi).

◀ BETTER

◀ BETTER

◀ BETTER

Editors' Choice

- Epson Stylus Photo
- HP PhotoSmart Printer



If you've been waiting for ink jet printers to be good for printing color photographs, your wait is over.

Ink jet printers continue to demonstrate great advances in print output. It's hard to imagine that you won't be ecstatic with the finished products you can get from printing photograph images with the Epson Stylus Photo (\$500 street) and the HP PhotoSmart Printer (\$500 street). These two printers differ in several respects, but when you use glossy photographic paper, both produce gorgeous output.

The Epson Stylus Photo printer does a great job printing text and mixed graphics. Other Epson Stylus printers are faster or bet-

ter choices for nonphotographic printing tasks, but the Stylus Photo printer's output and its ability to print at its highest resolution (720 dpi) make it a big winner.

Part of an impressive three-piece system, the HP PhotoSmart Printer produces knockout photo output. It's larger in size than the rest here, and it doesn't have a black ink cartridge, but both of these considerations fall aside quickly when you see the HP PhotoSmart Printer's deep, rich colors and sharp images. If you buy the whole package—including the PhotoSmart Scanner (\$500) and the PhotoSmart Digital Camera (\$400)—you'll have spent close to \$1,500, but you'll no longer have any need for conventional photography technologies.

The Alps Masterpiece MD-2300's Micro Dry tape printer is more costly and slower than the other units, but when it's equipped with the four-cassette photo printing tape set, the output is stunning. The Canon BJC-4550 does a very good job printing photographs and other image types. It also prints on 11- by 17-inch paper, making it the leader in the supsize-output class. The new Lexmark 7000 Color Jetprinter burned up the monochrome printing speed tests with unsurpassed black print. It also does a fine job with gray-scale text, color graphics, and photographic images.

tion—and we believe they are—this will be a great year for ink jet printers.

Alps Masterpiece MD-2300

The Alps Masterpiece MD-2300 features a unique Micro Dry printing process that uses a heated print head to form characters by pressing against colored ink ribbons. At a street price of \$750, the Alps is the most expensive printer of this group. Nevertheless, its print quality of both text and photographic images is first-rate.

The MD-2300 is relatively slow, rated at 2 minutes per page for black text printing and 15 to 20 minutes per page for color photographic-image printing. During testing, the Alps was the slowest of the tested printers when printing a five-page sample text document and a full-page photo spread, but it rested in the middle of the pack for printing a monochrome newsletter.

The key to the Micro Dry printing system is a series of four-ribbon cassette holders integrated into the fold-down front panel. Alps sells three different ribbon sets: standard black and three colors (\$6.60 for

each of four ribbons), metallic ink cartridges (\$8.99 each), and Photo Ink cartridges (\$11.99 for each of three colors and \$8.99 for a clear overcoat ribbon). The printer senses which ribbon type is in each cassette holder, so no special loading order is required. Unfortunately, you'll need a matched set for anything but monochrome black printing.

The Alps MD-2300 prints one color at a time, loading the ribbon cartridges in order. When you print a color photograph, for example (preferably using Alps' \$1.10-per-sheet photo paper for best output), the printer first loads the yellow ribbon and prints all the yellow on the page. It then draws the paper back into the printer, prints the magenta color element, and then makes a last pass with the cyan ribbon. The final step is the clear overcoat, which gives the entire photo print a shiny, protective finish.

The Alps consistently prints impressive work. Top resolution is 1,200 by 600 dpi in monochrome mode and 600 by 600 dpi in color mode. Every output sample we printed in the highest resolution modes looked superb. The only glitch we encountered happened when printing a pho-

tographic test image at 300 dpi; in this instance, colors overlapped and horizontal lines appeared.

Software bundled with this printer includes Adobe's Photo-Deluxe and a CD-ROM of ready-to-print photographic images. Alps' warranty covers parts and labor for one year, with technical support available Monday through Friday, 9:00 to 9:00 (eastern time).

If you don't mind paying a little more than average for the printer and waiting a bit longer for the finished work, you'll love the Alps Masterpiece MD-

2300 for its consistently beautiful output in all print modes.

Canon BJC-4550

The Canon BJC-4550 (\$500 street) is easily the most versatile printer in this roundup. In addition to very good print quality in all modes with its Bubble Jet technology, the Canon's maximum 11- by 17-inch paper size means you can use this workhorse for a variety of recreation-

Canon BJC-4550

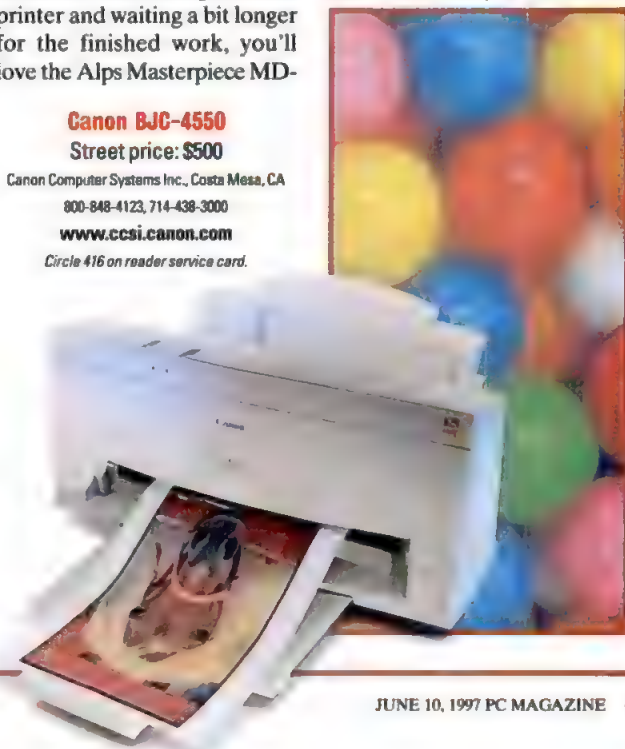
Street price: \$500

Canon Computer Systems Inc., Costa Mesa, CA

800-848-4123, 714-438-3000

www.ccsi.canon.com

Circle 416 on reader service card.



First Looks



Epson Stylus Photo

Street price: \$500

Epson America, Inc., Torrance, CA

800-463-7776, 310-782-0770

www.epson.com

Circle 417 on reader service card.

al, work, and family printing jobs. The Canon BJC-4550 doesn't quite match the highest-mode photographic-image print quality of the Epson and HP photo-centric units, but you can't beat its value as an all-around printer.

Top resolution in both monochrome and color printing is 720 by 360 dpi. For best output in all modes, Canon's High-Resolution paper (\$24.99 for 200 sheets of bright, white-coated stock) helps the printer create very crisp and clear images. Three types of ink cartridges are available for the Canon BJC-4550. The standard cartridge set includes a 900-page black cartridge (at 5 percent coverage) and a 4,000-page color cartridge (at 15 percent coverage). Replacements are \$28.48 and \$48.12, respectively. Also available are a \$42 neon cartridge for printing colors that glow under black lights and a photo

cartridge (also \$42) for printing in photorealistic mode.

The Canon was one of the faster printers here with normal-mode photo printing and the fastest of the reviewed group for printing a monochrome newsletter. Text-printing speed was second only to the very fast Lexmark 7000 Color Jetprinter.

This printer's output quality is very good, with consistently fine printing in all modes. Text samples were crystal-clear, and all color graphics and monochrome samples looked good on plain paper (with only minor grayscale image banding) and terrific on Canon's High-Resolution stock. Using this stock and Photo Inks, photographic images printed at the highest resolution setting available were very clear, with good skin tone and color and sharp detail.

The Canon's photo printing quality falls a bit short of Epson's and HP's photocentric printers in fine details and color richness, but by so little a margin that the wide-carriage versatility and all-around performance of this printer make it a better recommendation for general-purpose applications.

Canon's impressive software bundle, Canon Creative 2, includes two CD-ROMs with a variety of programs for printing greeting cards and other home and hobby applications using a common graphical interface. The CDs also hold Canon's online user manual. The vendor's one-year warranty includes cost-free 24-hour replacement, with weekday and Saturday toll-free technical support.

If you need the best possible combination of versatility and print quality, the Canon BJC-4550 is the obvious choice. While it is not the best at photo printing, the Canon's overall high standard and large-format paper handling make it a printing bargain.

Epson Stylus Photo



Last year's introduction of the Epson Color Stylus 500 printer showed that Epson was reaching new levels of value—bringing high-quality color output to the midrange color ink jet printer market. Since last year, Epson has introduced 1,440-dpi printers (the Color Stylus 600 and 800) that have also attracted favorable attention.

The knockout punch for the new Epson line may well be the six-color, 720-dpi Epson Stylus Photo printer, one of our Editors' Choices in this roundup. This printer (\$500 street) is surely photocentric, but it does a fine job with other print modes and will even print in its highest-resolution photo mode on plain paper—a feature no other ink jet printer offers.

For top photographic output, you'll want to use Epson's 720-dpi Glossy Photo paper (about \$15 for 200 sheets, or \$1 per page). There are no special photo ink cartridges here: All color printing is done with standard inks (black and color inks are priced at \$22.45 each). Printing at 720 dpi on plain paper works with photo mode and gives you a good indication of the colors and image characteristics. But when you switch to 720-dpi paper, the quality is so

clear it's almost spooky. And on the Glossy Photo paper, the resolution and level of detail are so impressive you'll think you're looking at a real photo.

Of the five printers tested in this roundup, only the HP PhotoSmart Printer produced richer, deeper colors on photographic image samples, with resolution and fine details being about equal. Even the color difference could arguably be considered a matter of taste and preference. You can alter the colors with software manipulation, although the test samples were printed at default settings. Epson bundles Live Pix 1.0 for photographic-image editing.

You won't win many speed-printing contests with the Epson Stylus Photo. But if you want fast output, you should look for a general-purpose printer anyway. The Stylus Photo printer is all about print quality, which it delivers in top form.

Printing in 720-dpi resolution costs about a penny per 8.5- by 11-inch page for each percent of coverage, so a full-page photo (with 1-inch margins) will cost about \$1. Typical 15-percent-coverage color graphics printing costs about 15 cents per page.

Epson's service and support package includes a two-year parts-and-labor warranty with

HP PhotoSmart Photo Printer

Street price: \$500

Hewlett-Packard Co., Palo Alto, CA

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We also stand firmly behind every product we make. A stance that benefits from the strong relationships we share with computing innovators such as Intel, Microsoft and Novell. It means responsive service, 24 hours a day. And it means your purchase is backed by an industry-leading 5-year/3-year limited warranty. In short, Micron is a company that holds your complete satisfaction above all else. Join us. We've not only built a bridge to the 21st century. We've crossed it. For directions on how to get here, call us today.



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www.micronpc.com

PERFORMANCE RULES WITH MICRON.

Only the latest technology goes into the Micron system that's right for you. No compromises. You get the most proven punch for the price. Period.

MICRON MILLENNIA

The Millennium family offers you an enlightening combination of performance and features to suit any budget.

MICRON MILLENNIA MME P200

Intel 200MHz Pentium® processor with MMX™ technology
16MB SDRAM
2.1GB EIDE hard drive
15" Micron 15FGx, .28dp (13.7" display)

\$1,899

Bus. lease \$65/mo.

Intel 200MHz Pentium processor with MMX
32MB SDRAM
3.1GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$2,339

Bus. lease \$80/mo.

Intel 200MHz Pentium processor with MMX
64MB SDRAM
4GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$2,599

Bus. lease \$88/mo.

SELECT FEATURES

512KB pipeline burst cache, flash BIOS
16V EIDE variable speed CD-ROM drive
3.5" floppy drive
100MB Iomega Zip drive

32 voice wavetable stereo sound and speakers
PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Tool-free minitower or desktop
Microsoft™ Intellimouse, 104-key keyboard

Microsoft Windows® 95 and MS® Plus! CD
Microsoft Office 97 SBE CDs
Multimedia Xcitement Pak
(composed of MMX technology-based software)
5-year/3-year limited Micron Power warranty

MICRON MILLENNIA MME P200 PLUS

Intel 200MHz Pentium processor with MMX
32MB EDO RAM
4GB Ultra SCSI hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$3,099

Bus. lease \$105/mo.

SELECT FEATURES

512KB pipeline burst cache, flash BIOS
PCI 32-bit Ultra SCSI Fast-20 controller
12X SCSI CD-ROM drive, 3.5" floppy drive
100MB Iomega Zip drive

32 voice wavetable stereo sound and speakers
PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Tool-free minitower or desktop
Microsoft Intellimouse, 104-key keyboard
Microsoft Windows 95 and MS Plus! CD

Microsoft Office 97 SBE CDs
Multimedia Xcitement Pak
(composed of MMX technology-based software)
5-year/3-year limited Micron Power warranty

MICRON MILLENNIA LXA P200

Intel 200MHz Pentium processor
16MB EDO RAM
2.1GB EIDE hard drive
15" Micron 15FGx, .28dp (13.7" display)

\$1,499

Bus. lease \$51/mo.

Intel 200MHz Pentium processor
32MB EDO RAM
4GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$1,989

Bus. lease \$68/mo.

SELECT FEATURES

512KB pipeline burst cache, flash BIOS
12X EIDE CD-ROM drive
3.5" floppy drive
16-bit stereo sound and speakers

PCI 64-bit 3D video, MPEG, 2MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard

Microsoft Windows 95 and MS Plus! CD
Microsoft Works CD
5-year/3-year limited Micron Power warranty

MICRON MILLENNIA PRO2 200

Intel 200MHz Pentium Pro processor
32MB EDO RAM
3.1GB EIDE hard drive
15" Micron 15FGx, .28dp (13.7" display)

\$2,399

Bus. lease \$82/mo.

Intel 200MHz Pentium Pro processor
64MB EDO RAM
4GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$2,899

Bus. lease \$99/mo.

SELECT FEATURES

Supports dual Intel 200MHz Pentium Pro processors
256KB internal L2 cache, flash BIOS
16X EIDE CD-ROM drive

3.5" floppy drive
100MB Iomega Zip Drive
16-bit stereo sound and speakers
PCI 64-bit 3D video, MPEG, 4MB EDO RAM

Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows 95 and MS Plus! CD
Microsoft Office 97 SBE CDs
5-year/3-year limited Micron Power warranty

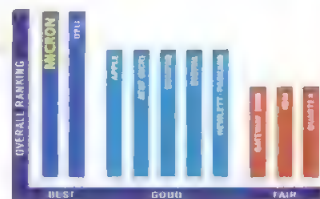


ASSURANCE DOWN THE ROAD.

Micron is a company of engineers, driven by performance and reliability. Our commitment to building better engineered computers shows. In the past two years, we've collected over 100 awards for product performance, customer service and reliability.

THE MICRON POWER™ WARRANTY

If we didn't believe so strongly in the quality of our products, we wouldn't package them with such a comprehensive warranty. The Micron Power warranty provides coverage with 5-year protection on microprocessors and main memory where most other companies give you three. Our industry-leading warranty also offers a 30-day money-back policy. Plus, 24-hour technical support.



Source: PC World best overall PC company for reliability and service December 1996

CALL NOW FOR DETAILED PRICING AND OPTIONS

UNCOMPROMISING TECHNOLOGY.

Performance rules with Micron.

Only the hottest, most current technology goes into the system that's right for you.

No compromises. With Micron, you get optimal performance for the price. Period.

THE MILLENNIA™ MME

The Millennium MME rockets desktop performance to a whole new world of computing power with an Intel 200MHz Pentium® processor with MMX™ technology, Intel's TX chip set and SDRAM.

Speed and productivity are enhanced as never before.

No compromises here. This remarkable machine also puts on an awesome



display of multimedia power with a 3D video adapter, MPEG and wavetable sound. Want more good news? The Millennium MME is designed to make upgrades a snap. So what starts out as a superior PC, can stay that way.

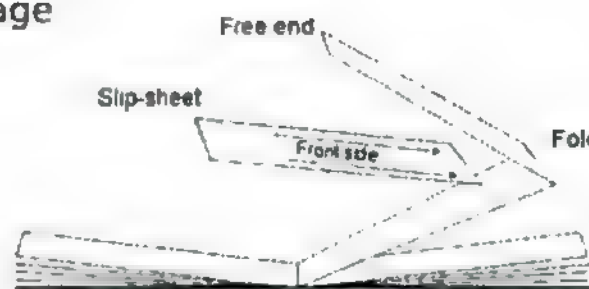
PENTIUM® PROCESSOR WITH MMX™ TECHNOLOGY. EXPANDING THE WORLD OF MULTIMEDIA.

All the great things the Intel Pentium processor does for performance, Pentium processor with MMX technology does better. Modern operations. 2D and 3D graphics. Video. Audio. The Internet.

Memory. Video conferencing and whiteboard collaboration. MMX technology gives the entire system a boost in performance like never before.



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



Inverted Foldout slip-sheet

Folded edge of the page

1. Open the foldout page

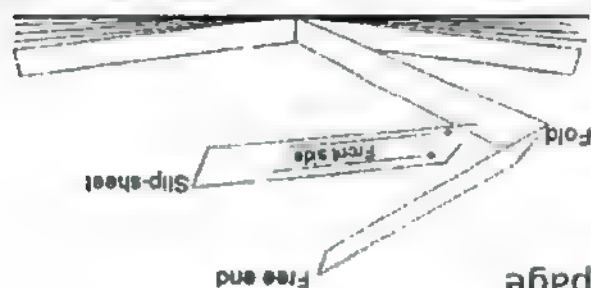
2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

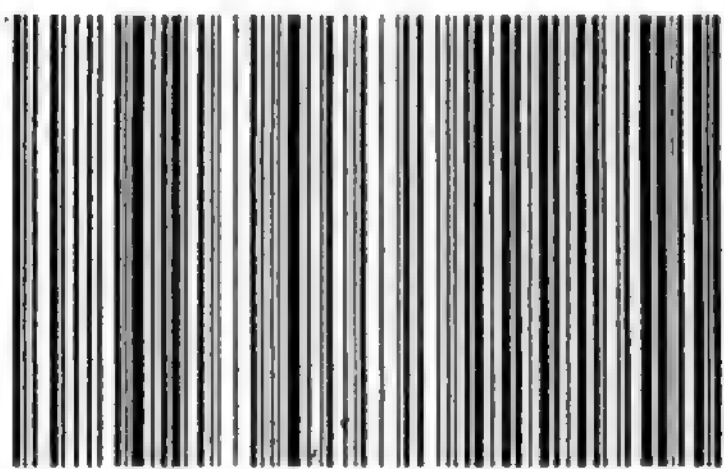
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

A COMMITMENT TO EXCELLENCE.

In a world where big-name performance, reliability and service are slipping, our customers and industry experts have voted to honor Micron with over 100 awards for these prized qualities. And that's just in the past two years.

You see, we're committed to delivering computers that perform better and run trouble-free longer than any other. And if support is ever needed, we're there to make things right for you, anytime of the day or night. Finally, your Micron PC comes backed by our industry-leading Micron PowerSM warranty. It all makes for very strong computers. And very satisfied customers. You have our word on that. Call today.

CLICK ON TO EXCELLENCE.

Click on www.micronpc.com for easy access to the most up-to-date and detailed information about our award-winning PCs. Take advantage of special Web site-exclusive features. And fast technical support. Visit today to find a Micron system built with your needs in mind.



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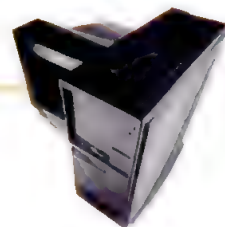
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YOUR MICRON PC. MAKE THE MOST OF IT.

MICRONHOME MIX

Award-winning Pentium processor based technology, an outstanding selection of software and competitive pricing make this a welcome addition to any family.



HOME MPC P166

Intel 166MHz Pentium processor
16MB EDO RAM
2.1GB EIDE hard drive
15" Micron 15FGx, .28dp (13.7" display)

\$1,599

With Intel 200MHz Pentium processor with MMX
With Intel 166MHz Pentium processor with MMX

add \$300

add \$100

HOME MPC P200

Intel 200MHz Pentium processor
32MB EDO RAM
3.1GB EIDE hard drive
17" Micron 17FGx, .26dp (15.8" display)

\$2,249

With Intel 200MHz Pentium processor with MMX
With Intel 166MHz Pentium processor with MMX

add \$100

subtract \$100

SELECT FEATURES

512KB pipeline burst cache, flash BIOS
12X EIDE CD-ROM drive
3.5" floppy drive
100MB Iomega Zip drive
32 voice wavetable stereo sound card with speakers
Advent A1270 2x25 watt stereo speakers
in P200 only
33.6 fax/modem, speakerphone, voice mail
Microsoft Phone telephony software

Internet ready: SPRYNET Internet trial membership, Microsoft Internet Explorer
America Online and CompuServe trial Membership
PCI 64-bit 3D video, MPEG, 2MB EDO RAM
Tool-free minitower or desktop
Microsoft Mouse, 104-key keyboard
Microsoft Windows 95 and MS Plus! CD
Microsoft Works CD

SystemSoft SystemWizard application for automated problem resolution
Quicken Financial Pak: Quicken Deluxe, Quicken Financial Planner, Quicken Parents' Guide to Money, Quicken Family Lawyer
Family Pak: ABC by Dr. Seuss, Thinkin' Things Collection 1, Earthworm Jim and Mechwarrior 2
Microsoft Home Bundle
5-year/3-year limited Micron Power warranty

OPTIONAL

MULTIMEDIA OPTIONS

32 voice wavetable stereo sound card **\$59***
32 voice wavetable stereo sound card with 2MB RAM **\$99***
Advent A1270 Powered Partners stereo speakers **\$79**
Advent A1370 Powered Partners stereo speakers with subwoofer **\$199**
Microsoft SideWinder 3D Pro joystick **\$59**
Microsoft SideWinder gamepad **\$39**

COMMUNICATION OPTIONS

33.6bd V.34 internal data/fax modem **\$139***
33.6bd V.34 internal telephony data/fax modem with speakerphone and voice mail **\$159***
3Com 3C509 network adapter **\$99**
3Com 3C905 Fast EtherLink PCI 10/100 network adapter **\$159**

NETWORKING OPTIONS

3Com 3C509 network adapter **\$99**
3Com 3C905 Fast EtherLink PCI 10/100 network adapter **\$159**

STORAGE/MEDIA OPTIONS

Adaptec 2940U Ultra SCSI Fast-20 controller **\$100**
(upgrade from system with standard Ultra SCSI Fast-20 controller)
Plexstor 12Plex 12X 1.8MB/sec SCSI internal CD-ROM drive **\$200***
(upgrade from system with standard 12X EIDE CD-ROM drive)
Iomega Jaz SCSI drive with 1GB removable cartridge **\$399***
Iomega ZIP IDE drive with 100MB removable cartridge **\$99**
Iomega 6-pack of 100MB ZIP cartridges **\$99**
Iomega Ditto 2000 (1/2GB) Travan tape backup drive with tape **\$149**
Iomega Ditto 3200 (1.6/3.2GB) Travan tape backup drive with tape **\$199**
Sony 4/8GB SCSI DDS-2 tape backup drive with tape **\$999***

HP PRINTERS

HP DeskJet 692c printer **\$329**
HP LaserJet 5L-FS printer **\$419**
HP LaserJet 6P printer **\$799**
Price includes cable. Additional DeskJet/LaserJet models available. Please call for details.

SOFTWARE OPTIONS

Edventure Pak: Sheila Rae the Brave, Putt-Putt Saves the Zoo, Reader Rabbit's Reading Development Library 1, Freddy Fish and the Case of the Missing Kelp Seeds, and the Thinkin' Things Collection 2 **\$69**
(available only on desktop and notebook systems with Windows 95)
Quicken Financial Pak: Quicken Deluxe, Quicken Financial Planner, Quicken Parents' Guide to Money, Quicken Family Lawyer **\$69**
(available only on desktop and notebook systems with Windows 95)

DISPLAY/VIDEO OPTIONS

17" Hitachi SuperScan 1711 (15.9" display) .26dp color monitor **\$150***
21" Hitachi SuperScan CM801 (20" display) .26dp color monitor **\$650***
Number Nine Imagine 128 series II video card, 4MB VRAM **\$299***
Number Nine Imagine 128 series II video card, 8MB VRAM **\$549***

SERVICE OPTIONS

Optional 1st year on-site service^a coverage included
Extended 2nd year on-site service^a coverage for desktop systems (with system purchase) **\$79**
Extended 2nd year on-site service^a coverage for desktop systems (after system shipment) **\$99**
Extended 2nd & 3rd year on-site service^a coverage for desktop systems (with system purchase) **\$99**
Extended 2nd & 3rd year on-site service^a coverage for desktop systems (after system shipment) **\$139**

DIGITAL CAMERAS

Kodak Digital Science DC20 camera **\$199**
Kodak DC25 digital camera **\$499**
Kodak Digital Science DC50 zoom camera **\$699**

OTHER OPTIONS

APC Per7T surge suppressor **\$39**
APC Pro7T surge suppressor **\$59**
Microsoft Natural Keyboard[®] **\$49**
(upgrade from standard keyboard)



* Upgrade from systems with standard 16-bit stereo sound card
* Requires SCSI host adapter
* Modern includes trial memberships to CompuServe and America Online
* Modern includes trial memberships to CompuServe and America Online, requires sound card
* Upgrade from systems with standard Micron 17" 17FGx color monitor

* Upgrade from systems with standard 64-bit 2MB video card
* 1st year on-site service is available in the United States and in limited areas in Canada from third-party service provider per customer's agreement with provider.
* 2nd year and 2nd & 3rd year offerings are available in the United States only.

Options and accessories available with system purchase only.

MICRON POWER WARRANTY

- 5 year limited warranty on microprocessor and main memory
- 3 year limited parts only system warranty (1 year for Transport A & B)
- 1, 2 or 3 year optional on-site service agreement for Micron desktop and server systems
- 30 days of free Micron-supplied software support for Micron desktop systems; 3 optional network operating system incident resolutions included for Micron server systems
- 30-day money back policy
- 24-hour technical support

The foregoing is subject to and qualified by Micron's standard limited warranties and terms and conditions of sale. Terms and conditions of sale may vary for (a) specific configurations. Copies of the limited warranties may be obtained on our Web site or by calling Micron.

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First Looks

Lexmark 7000 Color Jetprinter

Street price: \$400

Lexmark International Inc., Lexington, KY

800-358-5835, 800-232-2000

www.lexmark.com

Circle 419 on reader service card.

Buying the full PhotoSmart system will set you back a bundle, including \$500 for the 300-dpi PhotoSmart scanner (which includes a SCSI interface card) and \$400 for the PhotoSmart digital camera. The scanner works with prints as large as 5 by 7 inches at 300 dpi, and it scans 35-mm negatives and slides at 2,400 dpi. The camera takes digital images in normal, fine, and superfine modes and stores them on 2MB and 4MB HP Photo Memory Cards (with a capacity of 62 shots per 4MB card in normal mode). One 2MB card is included, with extras available for

\$50 each; 4MB cards cost \$75. If you buy the full PhotoSmart system, you'll be ready for some serious digital photography. You'll also be able to capture, scan, and print photos with ease. And the prints you get will rival conventional photos.

The PhotoSmart printer is unique in this group of four. The first thing you'll notice is its size—the HP measures 6.5 by 18.5 by 28.5 inches (HWD)—which makes it as large as many desktop PCs. There is no black ink cartridge for this printer, only two three-color cartridges (\$39.95 each) that combine for six-color printing. You can print black text, but the result is muddy brown.

HP does not publicize the printer's resolution or print speed ratings, choosing instead to stand on the merits of output quality alone. In our speed testing, the HP wasn't the slowest, but it wasn't the fastest either. When printing a full-page multishot photo image in normal mode on

plain paper, however, the PhotoSmart tied with the Canon BJC-4550 for the fastest time.

Where the HP PhotoSmart shines—and shines brightly—is in its intended application, printing full-color photographs on high-quality paper. The detail and color richness that this printer can produce will truly make it tough for anyone (short of a professional photographer) to tell whether the output is a computer printout or a commercial print. With HP's estimate of \$2 per full-page print (including ink and a single sheet of 8.5- by 11-inch photo paper), you'll quickly save money compared with commercial printing costs. With a one-year warranty and 8:00 A.M. to midnight weekday technical support, the HP is also backed by extensive online technical resources.

If it's a general-purpose printer you want, this device isn't it. But if you want to print lots of photographs, the HP Photo-

technical support available seven days a week from 9:00 to 9:00 (eastern time).

If you print lots of photographs—or want to—the Epson Stylus Photo is a great photocentric printer that can also hold its own with traditional printing jobs. Top-quality photo printing with plain-paper support makes the Epson a clear winner.

HP PhotoSmart Photo Printer



It's no secret that Hewlett-Packard makes a full line of top-quality ink jet printers. Justifiably, it has dominated this market for years. So it's not surprising that HP also makes a top-notch photocentric printer. If you're serious about photographic printing, our second Editors' Choice, the \$500 HP PhotoSmart Photo Printer (part of a new three-piece PhotoSmart PC Photography system) can't be beaten for printing photographic images from a variety of sources.

SUMMARY OF FEATURES

Photo Printers

■ YES ■ NO

Products listed in alphabetical order

	Alps Masterpiece MD-2300	Canon BJC-4550	Epson Stylus Photo	HP PhotoSmart Photo Printer	Lexmark 7000 Color Jetprinter
Price	\$750 (street)	\$500 (street)	\$500 (street)	\$500 (street)	\$400 (list)
Dimensions (HWD, in inches)	7.7 x 17.5 x 9.4	8.5 x 17.6 x 10.0	6.4 x 16.9 x 9.2	6.1 x 18.0 x 17.8	12.0 x 17.0 x 10.5
Maximum monochrome resolution (dpi)	1,200 x 600	720 x 360	720 x 720	Info not available	1,200 x 1,200
Maximum color resolution (dpi)	600 x 600	720 x 360	720 x 720	Info not available	1,200 x 1,200
Number of colors in photo printing	3	4	6	6	4
Rated monochrome speed (8 x 10)	3–5 min. per page	5 ppm	3 ppm	5 min. per page	8 ppm
Rated color speed (8 x 10)	3–5 min. per page	1 ppm	3 ppm	5 min. per page	3 ppm
Maximum paper size (inches)	8.5 x 14	11 x 17	8.5 x 14	8.5 x 11	8.5 x 14
Paper input capacity (sheets)	100	100	100	40	150
Special paper required for highest-resolution photo printing	■	■	■	■	■
Host-based processing	■*	■	■	■	■
Parallel/serial port	■ ■	■ ■	■ ■	■ ■	■ ■
Macintosh-compatible	■	■	■	■	■
Cost per black/color ink cartridge	\$6.60, \$9.99	\$28.48, \$48.12	\$22.45, \$22.45	N/A, \$39.95 each (two required)	\$32.95, \$38.95
Rated cost per 5% black page	1 cent	4 cents	4 cents	Info not available	2 cents
Rated cost per 15% color page	3.5 cents	14 cents	11 cents	Info not available	7 cents
Hardware/software low-ink warning	■ ■	■ ■	■ ■	■ ■	■ ■
Application software included	Adobe PhotoDeluxe	Canon Creative 2 CD-ROM	Live Pix 1.1, Live Picture 2.6 (Mac)	Microsoft Picture It!	Lexmark Workshop CD, LivePix CD
Technical-support hours (eastern time)	8:30–5:30 M–F	8:00 A.M.–10:00 P.M. M–F, noon–6:00 Sat	9:00–9:00, 7 days	8:00 A.M.–midnight M–F	10:00–7:00 M–F
Warranty	1 year	1 year	2 years	1 year	1 year

* This product does not support host-based processing under Unix and Windows NT

N/A—Not applicable The product does not have this feature



The Commodore 64 is a home computer that was first introduced in 1982. It was designed to be a low-cost, high-performance machine that could compete with the more expensive IBM PC and Apple II. The 64 was a significant success for Commodore, selling over 17 million units worldwide. It was also one of the most popular home computers of the 1980s, with a large and active user community. The 64's success was due to its combination of affordability, performance, and a wide range of software options. It was a true home computer that could do everything from word processing to gaming. The 64's legacy is still felt today, as it remains one of the most popular and well-known home computers of all time.



Incredibly fast. Incredibly available. Incredibly connected.

(Did we mention it was fast?)

56K.* For months, you've been hearing about this revolutionary new breakthrough in modem speed. Now, it's time you experienced the thrill of going nearly twice as fast as ordinary 28.8K modems.**

Introducing the new x2™ Technology 56K modems from U.S. Robotics, the fastest modems ever created for regular phone lines. x2 is not only available at your local computer store right now, it has also earned the quick support of most major Internet service providers, including America Online, CompuServe, NETCOM, and Prodigy. (Not to mention more than 500 other ISPs who have pledged their support – 200 of which are live now, with local access.)

And what about upgradability? Since x2 is software upgradable, you'll easily get performance enhancements over time. And you can rest assured that when the ITU-T committee recommends a 56K standard, U.S. Robotics will provide you with an easy upgrade path.

One company delivers the support of computer companies, worldwide acceptance by ISPs, and upgradability to the future standard – the same company that connects more people to the Internet than any other. Visit our Web site at www.usr.com/x2now or call 1-800-525-USR1 to find an ISP near you that has live x2 service today. What are you waiting for?

U.S. Robotics®



The SHOULDER

Also known as:

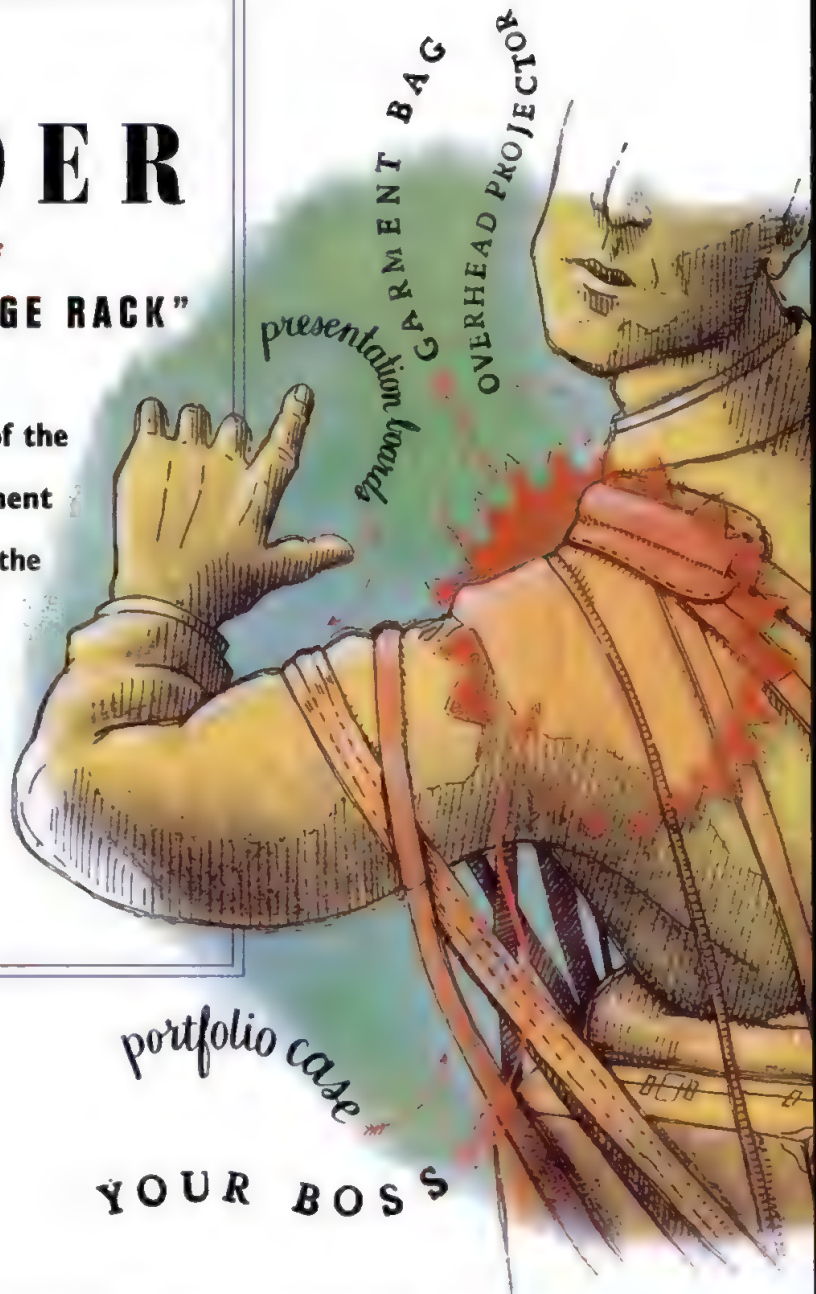
"YOUR PERSONAL LUGGAGE RACK"

Bent and bowed from the weight of the world—as well as briefcases, garment bags and gift shop impulse buys—the shoulder longs for a notebook it hardly knows is there.

FUJITSU

FUJITSU PC CORPORATION

Built for Humans.



YOUR BOSS

Designed for a portable world, the LifeBook™ 600 Series is fashionably light and thin. But in the corporate arena, performance is the bottom line.

Well, this notebook has all the power of a cigar-smoking executive. It features a 133MHz or 150MHz Intel Pentium® processor available with MMX™ technology* and an enhancement unit option to give your work that multimedia spit and polish.

*Intel Pentium processors with MMX technology available on select models only. LifeBook is a trademark of Fujitsu PC Corporation, and Fujitsu and the Fujitsu logo are trademarks of Fujitsu Ltd. The Intel Inside Logo and Pentium are registered trademarks, and MMX is a trademark of Intel Corporation. Microsoft, Windows, and the Windows logo are registered trademarks of Microsoft Corporation. All other trademarks or registered trademarks are property of their respective companies. ©1997 Fujitsu PC Corporation. All rights reserved.

Designed for

Microsoft®
Windows®95

**ONE PLEASINGLY
 PORTABLE NOTEBOOK.**

*The
 LifeBook
 600
 Series.*



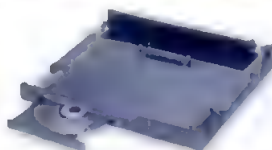
①

It's remarkably light—weighing in at 4.4 lbs. It's ultra-thin. At only 1.2", it slips easily into that jam-packed thing you call a briefcase.



2

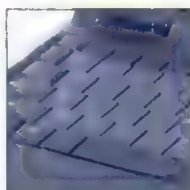
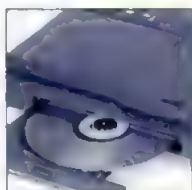
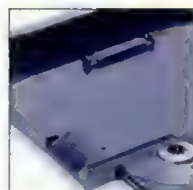
A second Lithium ion battery option for anyone with a serious work ethic. And a standard internal 33.6 fax/modem so the world knows it.



③

The enhancement unit houses an 8x CD-ROM, 3.5" floppy disk drive, stereo speakers and docking ports so you can take desktop power on the road.

Add it all up and the LifeBook 600 Series is one portable, powerful machine. A great combination for professionals who carry the business world on their shoulders.



A 12.1" active-matrix display and Zoom video support can help you carry off even the biggest presentation.

FUJITSU PC CORPORATION. For more info, call 1-888-4-ON-THE-GO, ext. F509, visit www.fujitsu-pc.com or get a QuikFacts fax at 1-800-936-5209.

First Looks

Smart Photo Printer is an outstanding choice.

Lexmark 7000 Color Jetprinter

The \$400 Lexmark 7000 Color Jetprinter uses laser-cut print nozzles to attain 1,200-by-1,200-dpi resolution in both black and color printing. Nominally a 600-dpi printer, the double-high resolution is created by making the print head take a second pass, balancing higher print quality with the faster printing afforded by 600-dpi mode. The fine control of the three-dimensional nozzle shapes allows Lexmark to sell this general-purpose printer at a very reasonable price.

Overall print quality is very

good with the Lexmark printer, but its strong suit is monochrome printing. The company calls its ink "super sharp waterproof black ink," but whatever the name, the black text, graphics, and gray-scale printing attained with the pigmented ink is a deep, rich, opaque black with crisp edges. Color printing is also competitive; it requires Lexmark's High-Resolution paper for top-resolution modes.

The 7000 Color Jetprinter is also the black-printing speed demon of this group, scorching the other printers on both five-page text and single-page monochrome newsletter printing tests. Color printing at top resolution—a two-pass process—was slower than most of the other ink

jet printers but faster than the Alps Masterpiece MD-2300.

The Jetprinter also includes on-screen ink-level indicators and progress job tracking. The company bundles the LivePix CD-ROM, a photographic-image-editing program that includes LivePix Gallery for organizing your scanned or downloaded images. The Lexmark Workshop CD-ROM includes eight separate applications for making greeting cards, certificates, T-shirt designs, labels, and comics. Also included are EarthLink NetWork TotalAccess and ArcSoft PhotoImpression.

Lexmark had not set per-page cost ratings at press time, but ink cartridges cost \$32.95 each for black and \$38.95 for

color cartridges.

Lexmark covers the 7000 Color Jetprinter with a one-year warranty backed by weekday technical support from 10:00 to 7:00 (eastern time). If you have problems during the warranty period, Lexmark will exchange your unit for a new printer by the next business day.

If you're in the market for a fast ink jet printer with good all-around quality (with special emphasis on outstanding black and monochrome gray-scale graphics printing), the Lexmark 7000 Color Jetprinter is the clear choice. It doesn't meet the high marks set by the Epson and HP printers in photographic-image printing, but it is a bargain in terms of quality and price.

MONITORS

Imposing Vision

Thin is in with Pixelworks' Plasmavision 42 screen.

—By Alfred Poor

The next time you try to make a presentation using a desktop monitor, imagine how much easier it would be for you and your audience if your display were 3 and a half feet wide diagonally. Now imagine that that same display was just 6 inches thick and (at 87 pounds) light enough to hang on the wall. You've just imagined the \$13,999 Plasmavision 42 from Pixelworks.

At 20.4 by 36.2 by 6 inches, the black display looks almost too thin to be real. The screen is a full 42 inches from corner to corner, which comes out to 40.8 by 25.2 inches—or just over 7 square feet—of display space. It has an 852-by-480-pixel resolution, displays 16.7 million colors, and connects to either a PC or a VCR.

The display conforms to the new 16:9 aspect ratio used by high-definition TV (HDTV), wide-screen movies on DVD, and Sharp's WideNote portable PC. A number of graphics

adapters also provide Windows support for the wide format, giving you more space to display information.

The panel is so thin because it's based on state-of-the-art plasma-display technology. As in an active-matrix LCD panel, each pixel is controlled individually, so you don't need heavy glass and a deep case to accommodate the electron guns of a conventional CRT monitor. But unlike an LCD, the plasma screen is emissive—that is, it produces its own light—so there is no need for a bright backlight.

The Plasmavision 42 uses tiny electrodes to excite gas plasma, which then causes phosphors to glow; these phosphors are similar to the ones used in a CRT display.

After a week of watching DVD-based movies, playing presentations, and performing

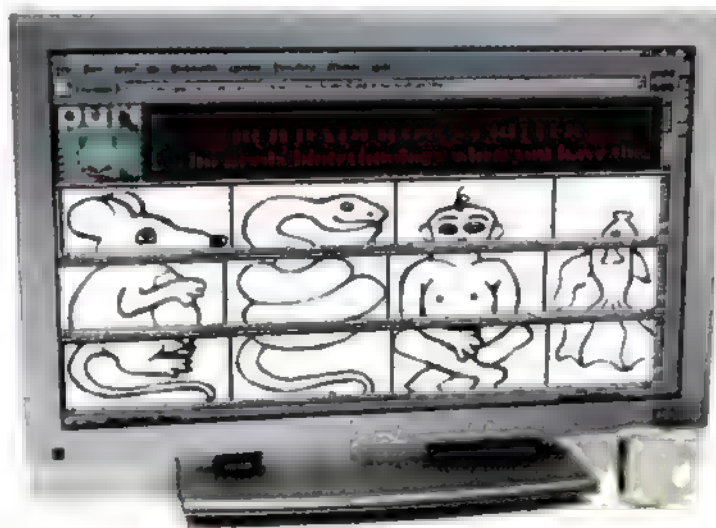
general computing tasks, we were quite impressed with this screen's consistently sharp, clear image. It's bright enough to use with standard room lighting, and it can be viewed clearly from a 160-degree angle. The Plasmavision 42 doesn't have as high a resolution as some of the large CRT tubes being made today by

aren't any cooling fans. A handy infrared remote control gives you easy access to on-screen control menus.

The display works well with standard computer graphics adapters; VGA images are shown in the center of the screen, surrounded by a small black frame. The panel can automatically scale 800-by-600 images to fit, although we found that you lose some of the images' detail in the process. There are also Wide and Zoom modes designed to expand images to fill the entire screen; this comes in handy when viewing a letter-box movie or video.

At \$13,999, the Plasmavision 42 has a bright future for conference rooms, public announcements, and entertainment. For traffic-stopping impact that will get your audience's attention, it's hard to beat. □

Plasmavision 42. List price: \$13,999. Requires: RGB or video input. Pixelworks, Portland, OR; 503-699-6682. Circle 402 on reader service card.



OFF THE WALL: Fujitsu General's Plasmavision 42 is thin enough to hang on the wall.

vendors such as Mitsubishi and NEC, but it's a whole lot easier to move around.

Fujitsu General makes the Plasmavision 42's screen, which accepts data and video inputs (NTSC, PAL, SECAM, and S-Video). A pair of 2-watt amplified stereo speakers provides adequate sound support, and it's whisper-quiet because there



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First Looks

MONITORS

Big-Screen Multimedia

Multipurpose monitors are equally at home in the boardroom and the family room.—By Bruce Brown

Television. Stereo. Computers. Big screens. Multimedia. DVD. Five decades' worth of technology has resulted in a variety of products, all of which are incorporated in or appropriate for use with the two large-screen monitors reviewed here.

Differing in size, price, and the ability to display high-resolution graphics, the 33-inch Arcadia AR3.1 (\$1,199 list) and the 29-inch Viewsonic 29GA (\$2,500 street) are good for a plethora of uses. Each will work well with presentation and entertainment systems, whether in business, education, or home applications.

TEST SETUP

For head-to-head testing of the two monitors, PC Labs used a 75-MHz Pentium Gateway 2000 Family PC with 24MB of RAM and an STB PCI-TV card. All television and graphics signals were cabled to an Extron P/2 DA4 video amplifier and then to the tested monitors. A 0.28-mm-dot-pitch monitor was also connected to the Extron for comparison.

For TV testing, we viewed cable sports, news, and music channels (the volume was turned up on the music channels to test the internal speakers). Sonera Technologies' DisplayMate for Windows Professional Multimedia Edition 2.0 was used to test the display quality of PC graphics.

ARCADIA AR3.1

Princeton Graphics Systems' Arcadia line was introduced this spring for use in PC/theater convergence apps. Two screen sizes

are available (nominally 29 and 33 inches) and two versions (with or without extra video inputs and high-level color controls). The 31-inch models include the \$1,199 AR3.1 (tested here) and the \$1,399 AR3.1AV, which adds inputs and color controls. Both have integrated stereo speakers.

The Arcadia uses Invar shadow-mask tubes (0.92-mm stripe pitch). Maximum PC graphics resolution for the AR3.1 is 800-by-600, which runs



TAKE CONTROL: Viewsonic's 29GA has a wireless remote.

at a fixed 60-Hz vertical-refresh rate. Other supported resolutions are 640-by-480 at 60 Hz, 75 Hz, and Macintosh-compatible 66 Hz. The panel on the AR3.1 has brightness, contrast, and

basic screen geometry controls. As a television display, the AR3.1's picture quality compares with standard TV screens. It lacks color controls (included on the AV model), so it is less adjustable than most conventional televisions. The big-screen image is very good, and as long as the preset settings maintain integrity over time, no one should complain about picture quality or color. The internal stereo speakers can't compete with external stereo systems, but the volume is loud enough for a good-size room and the sound is comparable to most standard sets.

You won't want to work closely with any monitor running at a 60-Hz vertical refresh, the maximum supported by the AR3.1 in 800-by-600 mode. In 640-by-480 resolution, a 75-Hz refresh rate means flicker-free performance.

The monitor's DisplayMate test results, run at 800-by-600 resolution, were consistently very good. Images weren't as sharp as on the comparison monitor (with its much smaller dot pitch), but on all tests the AR3.1 performed credibly as a computer monitor, with good focus and color uniformity and little observable misconvergence and regulation pulsing.

VIEWSONIC 29GA

Viewsonic's 29GA, introduced in 1996, remains the high-resolution combination computer monitor/multimedia display of choice. The price is comparatively high (\$2,500 street), but the Viewsonic's 29-inch screen, video and audio inputs and outputs, PAL and NTSC video compliance, and PC and Mac compatibility make this an incredibly versatile monitor. The 29GA also has internal 5-watt speakers and an infrared wireless remote control.

The Viewsonic's back panel has a good selection of jacks, and its front control panel is even more impressive: A cover drops down to reveal a selection of screen geometry, color, and input selection controls. A second front-panel door reveals duplicate S-Video, RGB, and composite video and audio inputs.

The 29GA was more like a conventional TV set than the Arcadia monitor, since the Viewsonic adds color controls and a remote. The internal speakers provided sufficient volume, clarity, and tone for typical-size boardrooms and classrooms. Extra video- and audio-out and pass-through jacks make the 29GA superb for multiple-monitor applications.



WIDE ANGLE: The Arcadia AR3.1 has a 31-inch viewable display.

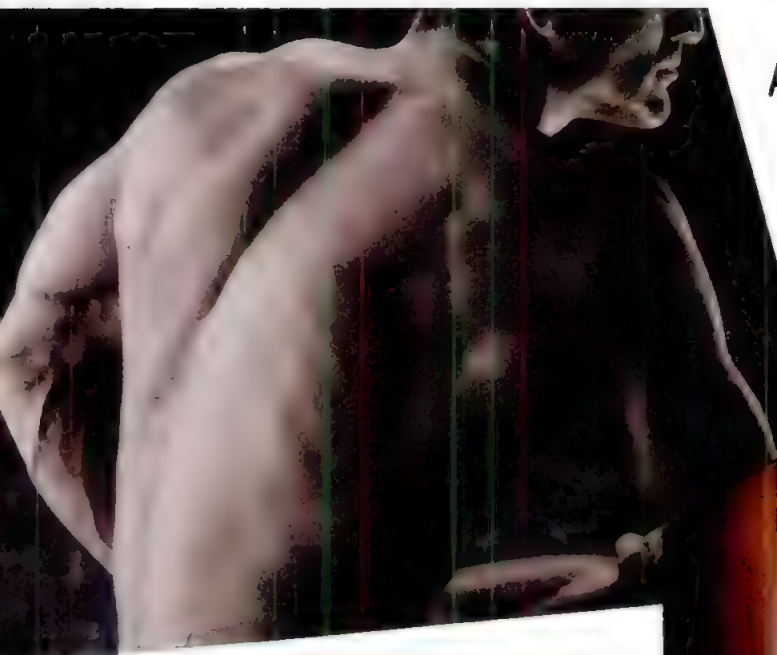
The Viewsonic supports vertical-refresh rates up to 80 Hz in 1,024-by-768 mode (it's compatible with resolutions up to 1,280-by-1,024). The 29GA's performance on the DisplayMate tests was similar to the Arcadia in 800-by-600 mode, but only the 29GA could go to higher refresh rates. And while the Arcadia maxes out at 60 Hz at 800-by-600 resolution, the Viewsonic ran successfully at 85 Hz at the same resolution. Color uniformity and geometry were right on the money, and the 29GA's convergence, resolution, and regulation were equal to or slightly better than the Arcadia in identical modes.

GREAT CHOICES

Either monitor is a good value. If you're willing to give up the higher resolutions and refresh rates supported by the Viewsonic 29GA in favor of a larger screen and a much lower price, the Arcadia AR3.1 is a great choice. If you want the added versatility of AV inputs, \$200 more buys the AR3.1AV version. If high-resolution computing on a big screen is your top priority (and you also need a wide selection of AV inputs), the Viewsonic 29GA is the right choice.

Arcadia AR3.1. List price: \$1,199. Princeton Graphics Systems, Santa Ana, CA; 800-747-6249; 714-751-8405; www.prgr.com. Circle 413 on reader service card. **Viewsonic 29GA.** Street price: \$2,500. Viewsonic Corp., Walnut, CA; 800-888-8583; 909-869-7976; www.viewsonic.com. Circle 414 on reader service card.

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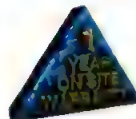


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First Looks

INTERNET UTILITIES

Get It? ... Got It! ... Good

Got It! caching software grabs Web pages and their links without the download wait.—By Brian Proffitt

Go Ahead Software takes the lead in the Web-page caching market with its \$49.95 Got It! program. As you browse the Web, Got It! automatically stores the pages in a cache. In future visits, the page can be reloaded quickly from disk, so you don't have to wait for an Internet transfer.

But Got It! goes beyond that. It scans through the page you are browsing for links to other pages. The program's Predictor module reads ahead and downloads those pages into the cache. When you click on a hotlink, the data is available much more quickly. In testing, this didn't visibly affect the responsiveness of the foreground page we were browsing, but the Predictor can be disabled.

Most products in this category already have this functionality. What sets Got It! apart from competitors like NetJet is its additional intelligence. Got It! monitors those sites you visit most often, so the cache is maintained with the pages you are most likely to use rather than just those you have visited most recently.

To maintain the cache's effectiveness, Got It! also includes a Pruner module. The pruning algorithm considers how frequently a page is accessed, when it was last refreshed, and how often a page's content changes. Having determined the relative importance of each page, it removes the least valuable information from the cache.

Using this importance ranking, the Fetcher module scans your favorite sites on the Web. If any sites have changed, Got It! updates them in your local cache automatically. The program also creates a News Page, which displays a list of Web pages that

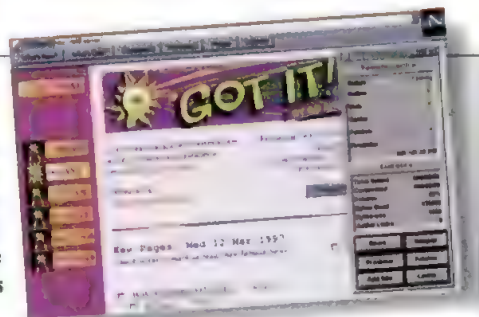
have changed or have been newly downloaded. Unfortunately, even a simple change in an advertising banner will cause the Fetcher module to download the entire page.

Once the cache was loaded, we were able to browse our favorite sites at length while disconnected from our ISP. We were also notified when we tried to access an item that hadn't

been cached. We could either go online to retrieve the item or go back to our previous page and remain off-line. This can be a terrific money saver for those paying for Internet access on a per-hour basis.

If you browse the same pages frequently and want to save time (and possibly money as well), you can get it with Got It!

Got It! List price: \$49.95 (\$39.95 download). Requires: 486 PC, 8MB RAM, Windows 95 or Windows NT 3.51 or later, minimum 10MB disk space for pro-



CH-CH-CHANGES: The News Page shows immediately which Web pages have changed.

gram and caching. Intelligent agent requires an additional 3MB RAM and 3MB disk space. Go Ahead Software, Redmond, WA; 800-631-0806, 206-882-1900; www.goahead.com. Circle 409 on reader service card.

INTERNET UTILITIES

Two Web Bloodhounds

From Web pages to phone numbers, NetFerret Suite and WebCompass can find them fast.—By J.W. Olsen

The day when you'll be able to find a needle in the Internet haystack without fuss or muss has just gotten closer with FerretSoft LLC's \$29.95 NetFerret Suite and Quarterdeck's \$50 WebCompass 2.0. You no longer need to navigate a half-dozen Web search engines manually to find the URLs you want. Nor do you have to delve through a half-dozen online databases to find someone's e-mail address.

FerretSoft LLC

NetFerret Suite

NetFerret Suite is the Swiss Army knife of Internet search tools. The package currently contains six fast, intuitive utilities that occupy a frugal 7MB of your hard disk. All are accessible from icons that are added to your Start menu's Find option.

When you enter a search term in the WebFerret

utility (www.ferretsoft.com/netferret/download.htm), it invokes your Internet connection and uses the most popular search engines to retrieve pages matching your criteria. You can configure WebFerret to skip certain search engines if desired; unfortunately, you can't manually add new search engines yourself. If you double-click on a URL that WebFerret finds, your Web browser opens and whisks you to its site.

The other five ferrets behave similarly. PhoneFerret searches online telephone white pages, and EmailFerret checks online e-mail databases. FileFerret tracks down files on the Internet, while IRCFerret and NewsFerret check Internet

Relay Chat servers and all newsgroups on your news server, respectively.

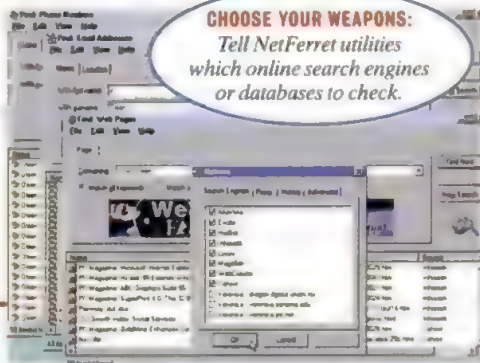
Like all suite utilities, these ferrets offer options that are context-appropriate to help fine-tune your searches. For example, you can limit phone-number searches by city. On the other hand, more sophisticated options found in many online databases (such as proximity operators) aren't supported.

These domesticated polecats won't drive every Internet rabbit from its burrow—they're only as good as the databases where they hunt. But until Internet-search technology itself matures, NetFerret Suite will be among your favorite pets.

NetFerret Suite. List price: \$29.95. Requires: 8MB RAM, 7MB hard disk space, Windows 95 or Windows NT 4.0, Internet connection with 32-bit TCP/IP stack. FerretSoft LLC, Pickerington, OH; 614-755-3891; www.ferretsoft.com. Circle 410 on reader service card.

CHOOSE YOUR WEAPONS:

Tell NetFerret utilities which online search engines or databases to check.



Quarterdeck

WebCompass

If NetFerret offers something for everyone, then WebCompass 2.0 is more of a one-trick pony. But

INTERNET SOFTWARE

CaptiveX-ating Controls

These six ActiveX controls liven your Web site by setting text and images in motion.—by Jeff Bertolucci

CaptiveX 2, the latest collection of ActiveX controls from NCompass Labs, can spruce up any Web site with eye-grabbing 3-D graphics and interactivity. Priced at \$195, CaptiveX allows Web-site developers to dazzle their audience with spinning cubes, simulated electronic light boards, text messages that appear to rush toward the viewer, and

other gee-whiz effects. On the other hand, CaptiveX's slick tricks are best handled by experts who are well versed in, HTML, ActiveX, and other Web machinery.

ActiveX controls are reusable software objects that programmers can embed in Web pages. For instance, a Wall Street firm could add an ActiveX control that incorporates a live stock tick-

while NetFerret glows in simplicity, the beauty of WebCompass lies in both its power and depth.

WebCompass explores Web search engines for URLs that match your criteria. It exceeds all other Web site metasearch utilities in the number of search engines it supports out of the box (35). WebCompass impressed us with its speed, which is partly attributable to its conversion from a CGI script in its initial release to a 32-bit desktop application in Version 2.0.

Like Symantec's Internet FindFast,

reuse, though, with some rough edges. For example, if you alter the active search engines, you must then save the modified configuration under a new name.

WebCompass excludes redundant URLs and dead links. Meanwhile, it creates a summary for each match and is reasonably adept at ranking its relevancy to your search criteria. You can search its summaries off-line and run a search at desired intervals. This will ensure that your off-line database remains current.

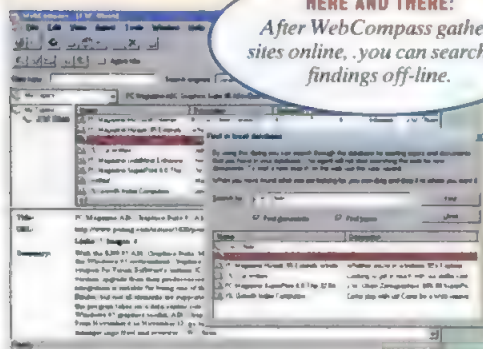
So if you want to locate relevant

Web sites with speed and ease (without compromising power and flexibility), WebCompass certainly fits the bill.

WebCompass 2.0. Street price: \$50. Requires: 8MB RAM, 5MB

HERE AND THERE:

After WebCompass gathers sites online, you can search its findings off-line.



WebCompass queries multiple search engines simultaneously. On one test we performed, WebCompass submitted 70 tasks simultaneously and then processed the results.

You can refine queries for

hard disk space, Windows 95 or Windows NT 3.51 or later. Quarterdeck Corp., Marina del Rey, CA; 800-683-6996, 813-523-9700; fax, 813-354-3329; www.quarterdeck.com. **Circle 411 on reader service card.**

er to a Web page. ActiveX effects play automatically on Microsoft's Internet Explorer browser; users of Netscape Navigator 3.0 will be forced to download NCompass Labs' ScriptActive plug-in (www.ncompass.com) to get the ActiveX experience.

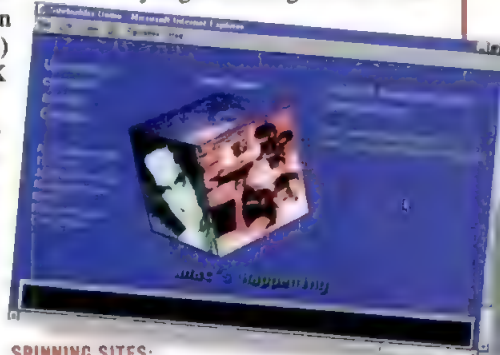
CaptiveX's six controls are best suited to advertising or promotional sites. Subtle they're not—for instance, the spinning 3-D cube can display bitmap images on each of its sides.

Using the mouse, a site visitor can spin the cube or make it appear closer or farther away. The LightBoard control lets you display text messages, which appear on a simulated electronic light board. With the PowerLabels effect, you can create a 3-D text message that rushes toward the viewer while spinning on its axis. MessageMorph displays text messages that meld together. PowerPanel shows images on a set of 3-D tiles, and Billboard shows text on a 2-D backdrop.

Each control uses various transitional effects—such as text and images that scroll across the screen or fade from view—to grab your audience's attention. Do they work? Absolutely. Although a spinning 3-D message might be annoying, it certainly can't be ignored.

To add CaptiveX effects to your Web site, you need an HTML-authoring tool that supports ActiveX technology; we used Microsoft's ActiveX Control Pad for this review. Choose Insert ActiveX Control from the Edit menu and select the NCompass Cube control from the Insert dialog box to insert the floating cube onto your HTML page. You can personalize the cube by adding bitmap images—such as an array of products—to its sides.

Like all CaptiveX controls, the cube will display image files in .JPG, .GIF, or .PNG formats. In Control Pad, you can easily assign images to the cube by right-clicking on the Edit



SPINNING SITES:

CaptiveX controls make Web sites come alive with rotating 3-D cubes, as seen in this Web page.

ActiveX Control window (which appears when you insert

an ActiveX control in an HTML document) and selecting the bottom Properties choice from the pop-up menu. Then add the path and file names of each image you'd like displayed on the cube.

Though it's possible to create these tags by hand, an ActiveX-enabled HTML editor greatly simplifies this task. You'll also need the NCompass conversion utility, which comes with the ScriptActive plug-in, to change your tags to a format that's viewable by Netscape users.

One significant drawback to seeing CaptiveX effects—or any ActiveX control, for that matter—is that most Netscape users who access your site probably haven't installed the \$21 ScriptActive plug-in. And while experienced site developers will have little problem inserting CaptiveX controls into Web pages, most end users will find the process confusing. Still, one thing is absolutely certain: CaptiveX 2 controls pack a visual wallop.

CaptiveX, Version 2. List price: \$195. Requires 8MB RAM, Microsoft Windows 95 or Windows NT 4.0. NCompass Labs, 604-606-0950, www.ncompass.com. **Circle 412 on reader service card.**



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First Looks

WINDOWS UTILITIES

A Trio of Windows Registry Trackers

ConfigSafe, C.Y.A., and InWatch keep an eye on your system's Registry.—By Barry Simon

A single errant line in the Registry can bring your system crashing to a halt, so using a program that tracks this Windows inner sanctum is an important safety net of modern computing. We looked at three programs that allow you to take a snapshot of the Registry, compare two versions of it, and restore your PC to an earlier—and hopefully better—state.

Rick Green's \$15 InWatch 95 shareware lets you store one previous system state, but it's more suitable as an uninstall utility. Meanwhile, the \$40 C.Y.A. 1.5, from Qualitas, lets you collect and compare multiple Registry snapshots, but you can only restore a complete Registry image. Finally, the \$60 ConfigSafe 95, from Imagine LAN, is the fastest and most flexible of the three products we looked at.

C.Y.A. 1.5.

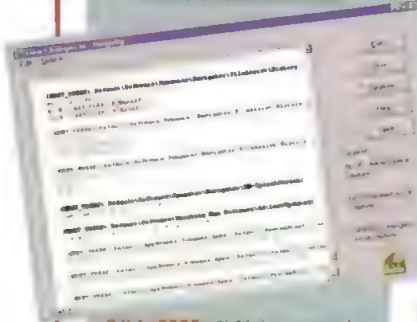
Street price: \$40. Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 3.1 or later.

Qualitas, Silver Spring, MD.

800-733-1377, 301-578-8400.

www.qualitas.com

Circle 404 on reader service card



C.Y.A. CODE: C.Y.A. uses color coding to show changes in the system configuration.

During our evaluation, we found that all three programs include various .INI files and the

ConfigSafe 95

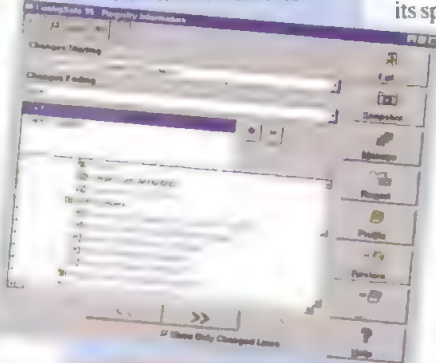
List price: \$60. Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later.

Imagine LAN, Nashua, NH;

800-372-9776, fax, 603-889-8822

www.imagine-lan.com

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SAFE UPDATE: ConfigSafe displays both the before and after values for changed keys with an arrow in the margin to show what has happened.

autoexec.bat/config.sys legacy files in their snapshots. InWatch is Windows 95-specific, while C.Y.A. works with every version of Windows since Version 3.1. ConfigSafe includes Windows 95 and 3.1 versions in one package, but it sells a separate \$99 Windows NT version.

As a stress test, we worked with a Registry that took up 5.3MB when exported to a text file, roughly five times the size of the Registry after Windows 95 is installed. We measured how long it took to record a new Registry and compare two versions of it.

Through and through, ConfigSafe is a class act. It displays changed values by showing the initial and final values next to each other, with an arrow between them pointing out the differences. It also lets you single out specific keys for quick comparison and restoration, although

you do have to choose these keys in advance.

ConfigSafe was the speediest of the three at generating a comparison of the Registry: 83 seconds, compared to 21 minutes and 57 minutes for C.Y.A. and InWatch, respectively. But for all its speed, ConfigSafe does have some minor flaws. For example, you can collapse parts of the Registry tree, but the program makes finding subkeys difficult because it doesn't list them in alphabetical order.

By contrast, C.Y.A. minimizes the disk space used for storing configurations. It stores the base configuration in full and records subsequent changes. It also stores the base data in a compressed .ZIP file. On our test system, C.Y.A.'s initial compressed file took up 600K, with updates adding about 100K. This is in contrast to ConfigSafe, which took up more than 5MB per save.

C.Y.A. lets you save your configuration each time you boot up or on a periodic basis. C.Y.A.'s compare report reveals added, removed, and changed keys and values, but it shows only initial differences rather than any new ones. Additionally, you can roll back entire sets of changes only, not individual items. Changing individual keys can cause problems, but it is a feature that most power users will want.

InWatch is intended primarily as a rudimentary uninstall utility. It should appeal to users who want to download a file from the Internet for limited use and then easily uninstall it, leaving no system remnants. You can save your configuration and later

compare the saved configuration to your current one; also, you can restore the initial configuration at any point. You can even save the results of a comparison, which shows which keys have been added.

InWatch does not tell you when a key changes due to its value being changed. You can only save a single configuration, which we found suitable for hit-and-run work on the Web but inadequate for long term Registry management.

InWatch was able to save a Registry in 90 seconds, while ConfigSafe and C.Y.A. managed the same task in 3 minutes and 19 minutes, respectively. InWatch is the only program here that saves a file listing for the Windows and system directories, and it includes changes in its comparison re-

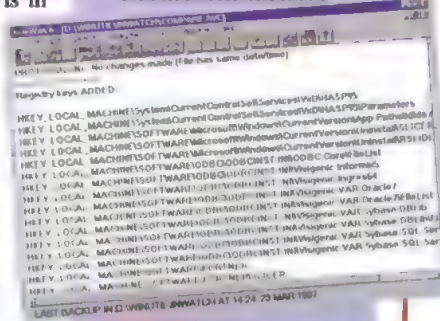
InWatch 95.

List price: \$15. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 95. Shareware version can be downloaded from ZDNet.

Rick Green, Port Coquitlam, British Columbia.

e-mail: rmgreen@fox.nts.na.ca

Circle 405 on reader service card



WATCH OUT: InWatch shows you only a listing of brand new keys without showing changed keys.

ports. InWatch, like ConfigSafe, also lets you look at subsets of the Registry (C.Y.A. can't do this).

InWatch is ideal for quick Web work, while C.Y.A. can save and compare multiple copies of your system configuration. Of the three, our favorite was ConfigSafe, which stands out as the Registry management program with the most depth.

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Survey by Ernst & Young

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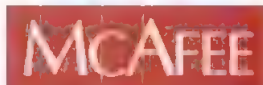
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First Looks

WEB SITES

Surfing for Jobs

Looking for a new career or just a better salary? The Web can help you do both.—By Brett Krasnowe

Job hunting can be an arduous task, no matter what methods you use. Help-wanted ads often leave job seekers with nothing more than eye strain and ink-stained fingers, while head-hunters, who work for prospective employers, often fail to produce results.

You can ease the job search by using a new breed of employment Web sites. A number of sites have cropped up to help you jump start your career. Here is a brief sampling of four of the newest offerings.

CAREERWEB

CareerWeb (www.cweb.com) is a good place for employers and job hunters to meet. Once online, you can search the employment listings of CareerWeb (CW) by multiple categories and locations or by keyword. The resulting links will take you to

CW's key feature for employers is its job postings, which cost \$115 per month. The company is required to provide a primary job category but can also include secondary and tertiary categories. CW offers annual membership for \$2,800, with a \$300-a-year maintenance fee. This provides unlimited access to the resume database. Other options include posting ad banners, a company profile, and a site link.

CAREERCITY

CareerCity (www.careercity.com) is another site that allows you to search either by multiple job categories and locations or by keyword. There are detailed instructions that help you refine your search, but CareerCity (CC) offers a number of tools to assist you in

There's also a Job Hunting Conference, which lets you ask the experts about job-hunting techniques and tips.

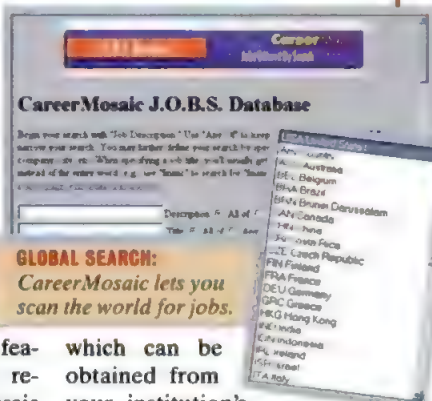
The site provides a daily article with job-search tips and a quiz that will tell you whether you're truly happy with your present occupation. CC allows employers to post up to 200 free job listings as well as search its resume database.

CAREERMOSAIC

The most extensive search features of the four sites we reviewed belong to CareerMosaic (www.careermosaic.com), which allows users to scan the world for jobs by specific countries.

The employer listings integrate company logos that link you directly to company Web sites. CareerMosaic (CM) boasts that it has thousands of job listings, but if that's not enough you can peruse CM's index of newsgroups. Several companies listed on CM have Online Job Fairs, which contain company information, links to jobs posted on CM, and links to employers' Web sites. The extensive Career Re-

leges. Find your school's name on Jobtrak's list of 500 institutions and enter your password,

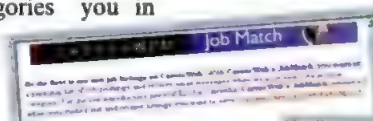
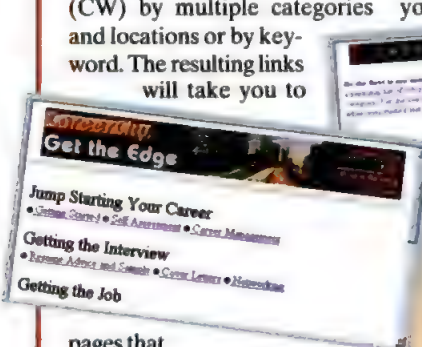


which can be obtained from your institution's career center.

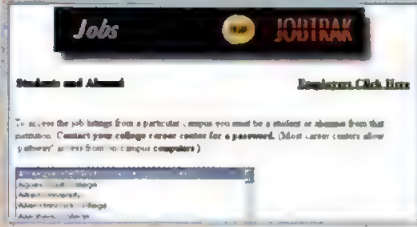
You can query Jobtrak's listings by job type, location, keyword, company, or date. Narrow your search by choosing whether you want a full-time, part-time, or summer job, or an internship. Job listings are sorted by date posted and can link you to a concise description of the company and the job, including days and hours and contact information. There's also an option to send your resume to the company.

Prior to posting your resume on Jobtrak, you have to enter personal information and fill-out a fact sheet that includes your college, degree, skills, and location preference. Jobtrak also has tips on resumes, interviewing, and careers, as well as other related sites and indices.

Employers can target a job ad for specific schools by using the Index to Colleges and Universities & Majors. The payment plans per posting (which range from two to four weeks) range from \$15 for one school to \$395 for all the schools. For \$20, the posting can also contain a link to the company's Web site; for \$4,500, the employer can be posted for one year to Jobtrak's Top Recruiters List, which contains logos, brief profiles, national job listings, and Web links. Job-Trak's revenues are shared with the career centers at the participating schools.



TIPS, PLEASE: CareerCity's "Get the Edge" answers your questions and gives advice (left). For \$25, CareerWeb's JobMatch offers you a leg up on other job seekers (top). Jobtrak lists job opportunities with help from your school's career center (right).



pages that feature company contact information and job descriptions. Several listings contain a company profile as well as an e-mail link to the company's recruiter.

You can also create a CW resume, which can be sent to a company and posted at no additional charge. Although the basic service is free, JobMatch, a \$25 three-month subscription service, puts together a personalized list of job postings and automatically sends you e-mail when jobs are posted in your category. There are also links to other career-related resources and articles.

your job search. The site's Resume Creator helps you produce a professional-looking resume. Once posted, each resume is kept in the CC database for about four months. You can also include up to three companies you wish to block from viewing your resume.

Get the Edge, another section of CareerCity, provides tips on starting a career, getting interviews, and snagging a job.

source Center includes resources listed by job category, and it provides links to professional and diversity associations; it even lists volunteer opportunities.

Employers can query the resume database by using a keyword search. The cost per job record is \$150, and the posting expires automatically after 30 days.

JOBTRAK

Jobtrak (www.jobtrak.com) is intended for students or alumni of specific universities or col-



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First Looks

PDA SOFTWARE

New Apps for Win CE

Here are four programs that add vital functionality to Windows CE PDAs.—By Rick Broida

In creating Windows CE, Microsoft outfitted the operating system with the bare minimum: Pocket Word, Pocket Excel, Internet Explorer, and some ancillary utilities. For the most part, it'll be up to third-party software developers to dish out the serious applications that will transform these diminutive PCs from novelties into necessities.

This first wave of standalone applications features a contact manager (ACT! for Windows CE), a note-taking program (QuickNotes), a handwriting-recognition program (Jot), as well as a notepad/calculator (TakeNote!). The future of CE computing looks bright indeed, because these four apps definitely deliver.

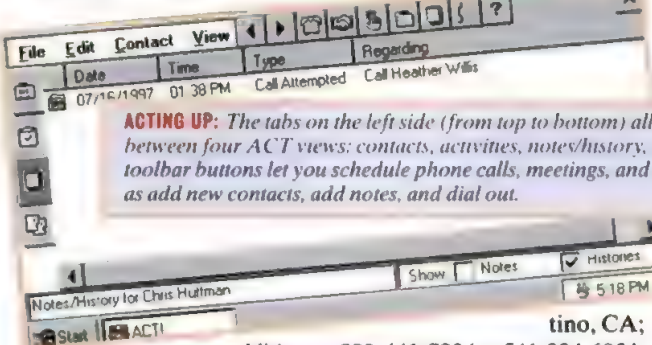
Symantec Corp.

ACT! for Windows CE

If you experience separation anxiety every time you are away from your desktop contact manager, then fret no more. Symantec's \$99 ACT! for Windows CE faithfully duplicates enough of its Windows 95 cousin to make traveling worthwhile.

By giving you a wide assortment of tools for organizing contacts, tasks, calls, and meetings, ACT! strikes an equitable balance between the desktop and the PDA. It has the same clean, friendly interface as ACT! for Windows, and it keeps the most important information in your face, including ACT!'s coveted contact-grouping features; automatic notification of scheduling conflicts; history logs of all your calls and meetings; daily, weekly, and monthly calendar views; and alarms.

At the same time, you forfeit some of the features that give ACT! its edge. Customizability is virtually nonexistent. In



addition, you cannot modify field names, and you are limited to a handful of preset contact-view layouts. Inexplicably, the task list is buried in the calendar instead of being listed in the View menu.

The key feature of any portable contact manager is how easily it synchronizes with the motherlode of information on your desktop PC. U.S. Robotics' PalmPilot sets the standard with its one-button hot-sync; ACT! requires you to navigate your way through a few menus. Still, the process is easy and gives you greater control over synchronization options.

On our tests, data transfers worked flawlessly, if a bit slowly. It took about a minute to send just 40 contact listings to a Compaq Companion. Then, once we'd made some changes to both our desktop and HPC databases, it took about three minutes for them to synchronize. Remote synchronization via modem or network is not supported.

Like other Windows CE applications, ACT! is anything but thrifty, requiring 340K of memory. That said, ACT! for Windows CE is the best choice for keeping your vital information on hand and in sync.

ACT! for Windows CE. Street price: \$100. Requires: 340K. Symantec Corp., Cupertino, CA;

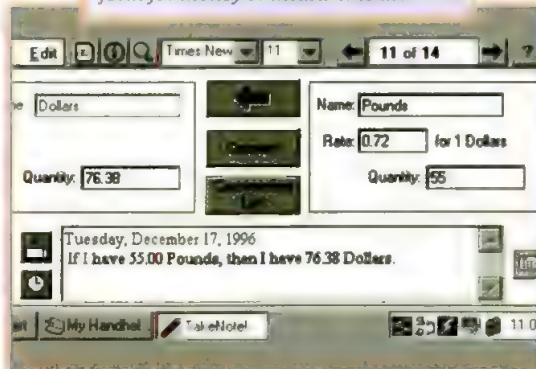
800-441-7234, 541-334-6054; www.symantec.com. Circle 406 on reader service card.

CIC

Jot

Unless you have Lilliputian fingers, touch-typing on an HPC can be positively maddening. It can also be impractical, especially if you have to hold the unit with one hand and type with the other. Enter Jot (\$69 list), from

NOTES PLUS: Among the features included in TakeNote! is a quick conversion form for money or measurements.



Communication Intelligence Corp., a fast and effective handwriting-recognition utility that belongs not only on every HPC but also in Microsoft's next iteration of Windows CE.

Once installed, the 86K Jot works behind the scenes, with an icon in the system tray serving as its on/off switch. When Jot is active, two Mode Mark pointers flank the screen, dividing it horizontally. Characters written below the line—in the bottom two-thirds of the screen—appear lower case, while characters extending into the top third appear upper case. From a practical point of view, you should only write

in the top third of the screen to get numbers and equation symbols. An extended character set—complete with symbols and accented characters—is available by drawing a mode-switching vertical line.

Jot is easier to use than the Graffiti handwriting-recognition system for the PalmPilot, because Jot's characters are quite natural. The software even supports two-stroke letters such as "t." You needn't abandon your pen for cutting and pasting, either; Jot can perform those functions as well as copy and undo.

Jot worked seamlessly with every Windows CE application we tried. Recognition was instantaneous—the software transcribed characters as fast as we could write them. We found Jot's accuracy to be nearly perfect, especially after we'd practiced a bit.

A macro editor lets you assign phrases and actions to user-definable code-letters. For instance, you can insert "PC Magazine" into a document just by writing "PCM," or you can use the letter "D" to insert the date. Nevertheless, to implement a



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a c c e s s

Information Access: You'll find that the Compaq Web site offers the most extensive software support known to PC-kind. Also, as software upgrades become available we send them to you via CD-ROM. Just two of the ways that you will find Compaq gives you access to the information you need.



*Price mentioned is estimated street price for entry level models. Dealer prices may vary. Prices do not include monitors. †Certain restrictions and exclusions apply. ©1997 Compaq Computer Corporation. All rights reserved. Compaq and Deskpro registered U.S. Patent and Trademark Office. Features vary by model. Some features available with Compaq Deskpro and independent software applications. Other features only available on Windows 95. The Intel Inside Logo, Pentium and Pentium II are registered trademarks and MMX is a trademark of Intel Corporation. Other products mentioned may be trademarks or registered trademarks of their respective companies.



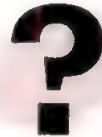
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Maximized Storage: Did we hear someone say storage? How does 120MB of floppy storage sound? First offered by Compaq, the LS-120 Drive provides increased storage, performance and is backwards compatible with current 1.44MB diskettes. And on selected Compaq desktops, you get something that many other PCs don't offer: PD-CD Drives. This gives you the option of reading current CDs or utilizing 650MB of rewritable storage.



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COMPAQ

Has It Changed Your Life Yet?

First Looks

macro you have to use a two-step process that's somewhat awkward, and for this operation the software pauses a second or two before execution.

Jot's trainer doesn't work in the traditional sense. Rather than record specific characters as you write them, the trainer merely lets you choose between different writing styles—and only for a handful of characters. Selecting a one- or two-stroke "J" is about as sophisticated as the trainer gets.

Still, that's a minor quibble. Jot quickly and accurately converts handwritten text, numbers, and symbols into their electronic equivalents, giving you welcome freedom from the confines of tiny keyboards. If there's one utility you and your HPC shouldn't be without, this is it.

Jot. List price: \$69. Requires: 86K. Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242, 415-802-7888; fax, 415-802-7777; www.cic.com. *Circle 407 on reader service card.*

CIC

QuickNotes

When all you want to do is scribble a few notes, sketch out an idea, or doodle during a meeting, you don't need handwriting recognition—you need a blank sheet of paper. CIC's QuickNotes turns your HPC's screen into an electronic notepad and your pen into a virtual Bic.

With a slim toolbar across the top and a column of buttons along the side, QuickNotes, Version 1.5, leaves most of the screen available for scribbles. You can choose between thin, medium, and thick lines. Even though there is no undo button, there are two erasers—a large one and a small one—at your disposal.

The program couldn't be simpler to use: When you draw on the screen, digital ink immediately flows from the pen. There's no delay between the

movement of your stylus and the appearance of your strokes.

QuickNotes does an excellent job of organizing your scrawlings. Once you've filled the screen, the tap of a button creates a new, blank page. The first page is then represented by a thumbnail, which gives you an immediate reminder of its content. To return to that or any other page, simply tap the thumbnail. QuickNotes can also assign a date/time stamp to each page, and it will even update the information if you make changes later on.

If your HPC has

SCRIBBLESCRABLE:

QuickNotes turns your Windows CE machine into a virtual notepad.

a limited amount of RAM, you might find that QuickNotes fills it fairly quickly. The program itself nabs anywhere from 60K to 80K of storage space, depending on which processor is in your HPC. It also requires between 40K and 60K of available program memory to operate (again, depending on the CPU). Individual pages average only 2K apiece, thanks to built-in compression. But like all other things with an HPC, this adds up quickly.

What QuickNotes lacks is a portrait mode (like that of Apple's Newton), which would allow you to turn your HPC sideways and work with a page that's long instead of wide. Furthermore, there's no way to export your entries for use in other programs. At the very least, the next version of the software should possess copy and paste capabilities or a one-button fax command.

If you can live with these shortcomings, you'll find QuickNotes an excellent addition to your HPC. It's fast, extremely easy to use, and undeniably handy to have around.

QuickNotes, Version 1.5. List price: \$24. Requires: 60K

to 80K. Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242; www.cic.com; *Circle 407 on reader service card.*

LandWare

TakeNote!

An electronic scratch pad is just one of the five note-taking modules included in LandWare's TakeNote! The other four features—a text-based notepad, a conversion form for

many drachmas in a \$20 bill? You supply the exchange rate and the form gives you the answer. As for converting measurements, TakeNote! doesn't supply any of the necessary formulas—you'll have to look them up and fill them in yourself.

The trip form lets you keep track of important flight information, including dates and times, seat and confirmation numbers, and airlines. It also has a lengthy notes field, so you can record extra information about your trip. But what about journeys made by car? A mileage-tracking form is glaringly absent.

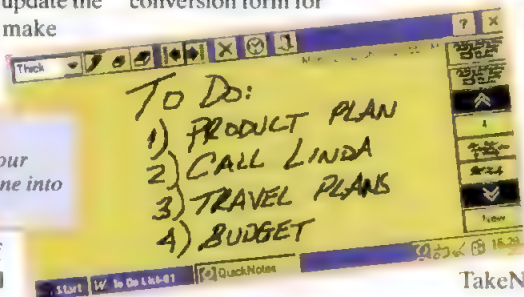
A fine complement to Windows CE's built-in contact-management tools,

TakeNote!'s phone log has a generous notes field, a date/time stamp, support for memorized text, and direct links to Windows CE's contacts database. If you're not planning to use a full-blown contact manager like ACT!, the phone log alone is worth the price of admission.

TakeNote! comes with three bonus applets that are separate from the main program. The LaunchBar is a system-tray icon that, when tapped, reveals a hotlink list of frequently accessed applications, files, and directories. NewTask and NewContact are desktop icons that let you add entries to Windows CE's Tasks and Contacts applications without having to load them first.

The complete TakeNote! Package uses 160K of your HPC's memory. TakeNote!'s conversion form is not very useful, and we'd happily toss the air-travel form in favor of one that tracks mileage. But the ink notes and phone logs are well worth having—ergo, so is TakeNote!

TakeNote! List price: \$39.95. Requires: 160K. LandWare Inc., Oradell, NJ; 800-526-3977, 201-261-7944; fax, 201-261-7949; www.landware.com. *Circle 408 on reader service card.*



currencies and measurements, a phone log, and a form for keeping track of flight information—are of mixed quality and usefulness.

As a drawing tablet, TakeNote! is a bit more robust than QuickNotes. Like the latter, it provides three separate line-thicknesses and holds as many pages as your HPC's memory can accommodate. But TakeNote! adds two shades of gray and white to your scribbles, while QuickNotes can only work in black. Plus, TakeNote! has an undo button.

Want to paste your signature or a drawing into a Word document? The ink-note module can export pages as bitmap files, and it supports copying and pasting. It may not have QuickNotes' handy thumbnails, but flipping between pages is as easy as tapping an arrow button.

A TakeNote! page doesn't have to be limited to electronic ink. It can also contain a text note, complete with different character sizes and fonts. TakeNote!'s convert form is designed to provide quick conversions between currencies, measurements, and so on. How

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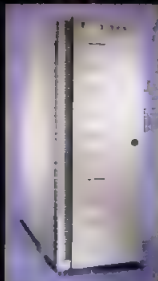
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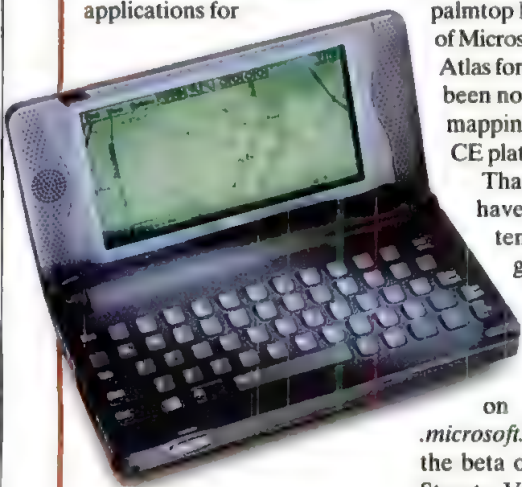


Second Looks

PDA SOFTWARE

Wherever You Go, There You Are

When we first looked at the initial crop of Windows CE handheld PDAs, applications for



this nascent platform were few and far between. You pretty much had to rely on what Win-

dows CE itself provided, and that was scant at best. For example, although the Psion 3c palmtop PC has had a version of Microsoft's AutoMap Road Atlas for some time, there has been no comparable digital-mapping application for the CE platform.

That is, until now. If you have a Windows CE system and want to add a geographic perspective to your daily work, then steer yourself over to Microsoft's site on the Web (www.microsoft.com) and download the beta of Pocket AutoMap Streets, Version 1.0, and your choice of digital maps.

There are about 40 maps available for metropolitan areas

from Albuquerque, New Mexico, to Washington, D.C. These maps are moderately detailed and each takes up between 200K and 500K of storage space. Add that to the 875K for AutoMap Streets and you will quickly fill up the available memory of these diminutive devices.

This is in contrast to Psion's version, which is packaged on a flash card that's about the size of a matchbook. You can load the Windows CE AutoMap set on a flash PC Card, but when we tried this we soon discovered that performance degraded markedly.

Pocket Streets is a work in progress, so changes are likely to be made before its fall release. You can search a map in two ways: by

street address or by your destination, such as a specific restaurant, hotel, or popular museum. Unfortunately, the program can't be searched by ZIP Code. The program marks your destination prominently, although it can't suggest a route or directions to help you get there. Nevertheless, you can zoom in on an area as well as pan the map in order to see what's nearby.

Although the maps can be hard to read at times on this platform's four-level gray-scale graphics, Pocket Streets gives you the choice of a gray or white background, which helps make them more visible. These maps are an end to themselves; in other words, you can't print, fax, or copy them directly into another application, such as Pocket Word or Pocket Excel. You can compare two locales by running two maps at once, but you're likely to run out of memory.

ACCESSORIES

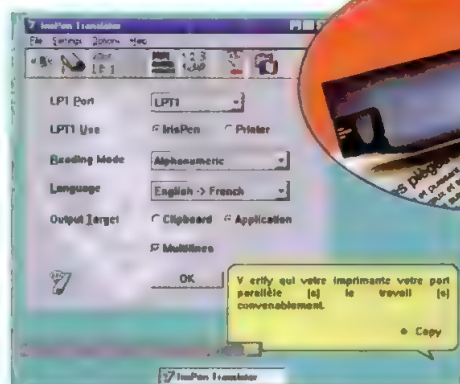
The Polyglot Pen

Over the years, the IRISPen, a unique handheld scanner that can capture a line of printed text, has improved incrementally. It's an excellent example of a product that remains outwardly unchanged while gaining significantly augmented abilities with the help of add-ons and new software (First Looks, November 8, 1995, and June 11, 1996).

The latest iteration is IRISPen Translator, which goes beyond its predecessor's ability to scan a line of text and read it back with a synthesized voice. IRISPen now reads and speaks French, but not quite fluently. Just pass the highlighter-sized pen over a line of English text from a magazine or book and

the system uses optical character recognition to convert the text into digital form. Then the system will either speak it back to you in English or translate it for you into French.

Though innovative, technically interesting, and unique, the IRISPen Translator works best when you scan large, well-defined black characters printed on a white background and when you feed it straightforward, direct passages. Unfortunately, it behaved like a fish out of water when converting tech-



PEN NAME: IRISPen can translate English to French, and vice-versa. Here, the original is, "Verify that your printer parallel port(s) work(s) properly."

nical, jargon-heavy passages. For example, on many lines lifted from *PC Expert*, our French-language sister publication, IRISPen produced nothing more than correctly accented gibberish.

Unfortunately, if you want IRISPen to learn a foreign lan-

guage, you will have to spend some money. The Translator software upgrade will cost you \$99; if you buy the whole package from scratch, including the IRISPen scanner, the price goes up to \$428. Look for IRISPen Translator to expand its repertoire by including Japanese, German, and other languages as well.

So if you want some help reading a train timetable in French or figuring out what escargots really are, IRISPen Translator can do it for you one line at a time.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Brian Nadel via MCI Mail (556-1500), CompuServe (72241,1616), or the Internet (bnadel@zd.com).

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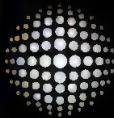
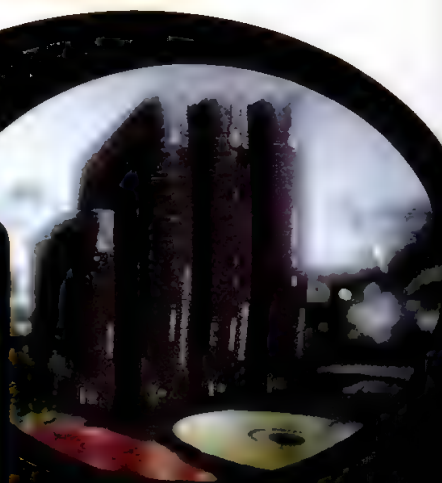
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Look out, AT&T. Move over, Bell Atlantic. Make way for MTS, the latest star on the telecommunications scene. You haven't heard of MTS? Not surprising. It's only days old and it's rather small, but it's having a sizable local effect. It's called Machrone's

Telephone System, and it's built around a modem-size black box from Centrepont Technologies.

Centrepont's new Switchboard is a tiny private branch exchange (PBX) tailored for the home and SOHO market. You connect it to two incoming lines and it routes calls to four extensions. You can use normal, inexpensive analog phones and have full access to Switchboard's features.

These features are, in a word, remarkable. Switchboard offers all the things you wish your home or SOHO phone system could do, such as conference calling, call transferring, putting callers on hold, acting as an intercom, and using prioritized or selective ringing. You can dial or answer either line from any phone. It also does a number of incredibly handy things that probably never crossed your mind. Switchboard has two more "extensions" that you don't see on the back panel: an internal fax modem and a remote phone number, which can be your cellular phone or any other number to which you want calls forwarded.

If you answer a ringing telephone and you hear fax tones, you merely press the extension number of the fax and hang up. If you have fax tone detection enabled, Switchboard automatically answers in fax mode. If you're going to be out of the office, you can forward calls to the number you've defined as remote. Switchboard will also do callbacks and call routing, saving you from high cellular phone rates by letting you route long-distance and international cellular calls through your home-office phone when you're not there.

Switchboard is PC-aware but not PC-centric. Unlike many PC-based phone products, it connects with your PC via a serial port but works just fine without using a PC at all. The PC makes programming Switchboard a simple task, but you can enter all the same commands and parameters through a Touch-tone keypad.

The biggest challenge I had installing Switchboard (other than finding a place to plug in yet another power supply) was deciding whether it should be close to the phone panel in the basement where the incoming lines and extension lines all

come together, or whether it should be by the desk that holds all our computers, the two-line phone, and the answering machine. Some years back, I'd installed a modular RJ-11 jack panel behind the desk. It has the phone lines, the ISDN line, a couple of network connections through shielded twisted-

pair wire, and a jumper that completes the phone circuit from one of the lines to my daughter's room. (Teenagers need lots of phone access, but not unrestricted phone access. The ability to unplug her line also shields her from those random nuisance calls that come in the wee hours of the morning, usually from strangers who can't see or dial straight.) The jack panel simplified the installation and integration with our existing phones, and Stephanie is delighted that she now has access to either line. I'm going to run our other extensions through the jack panel, too. You may want to install yours at the phone panel and run a serial cable to it from your computer.

Switchboard generates its own line and ring voltages, so extensions that you've plugged into it are invisible to the phone company's central office. You don't have to worry about overloading your lines with too many ringers, and your intercom calls are completely private. Intercom calls have a different ring pattern than outside calls, and Switchboard passes through any distinctive ring patterns you may already have on your lines.

You can select either of two user profiles for day-versus-night or home-versus-away activity. They determine which ex-

tensions ring and in what order, whether calls get forwarded, and which of two digitally stored outgoing messages gets played. You can invoke these profiles from your PC, from an internal phone, or even remotely via a password.

This first version of Switchboard is a robust product full of desirable features for the small office or the large home. Subsequent versions will have even more capabilities, including call logging and full TAPI integration. At \$495, Centrepont's Switchboard has no competition. The closest product I've seen is Panasonic's 3- by 7-line analog PBX, which sells for around \$800. Look up Centrepont at www.ctrpoint.com or call 613-725-2980. □



MACHRONE PHONE

Centrepont's new Switchboard does all the things you wish your home phone would do.

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All kidding aside, if you own a small business, the Dell PowerEdge 2100 really is a beautiful server. Just look at what *Network Magazine* had to say about it. "The Dell PowerEdge 2100 is designed specifically for small business environments and offers outstanding functionality, performance and customer support at the right price." Need more? The editors also went on to report that its advanced features like a 200MHz Pentium® Pro Processor, ultra-wide hard drives and a PCI Ultra/Wide SCSI-3 Controller will, in their words, "add

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Do Not Pass Go, Do Not Collect \$200

The possibility of being sued or even going to prison for posting something on the Web is more likely than you think. It's already happened: An American sits in a German prison for posting neo-Nazi ramblings on the Web. In Germany, it's illegal to publish

Nazi material regardless of its origin. The U.S. wouldn't extradite the man responsible, so he was arrested as soon as he arrived for a vacation in Denmark.

Web producers, content providers, and advertisers may be breaking other countries' laws for publishing remarks they take for granted in the U.S. The immediate threat comes not from dictatorships and fascist societies but from individual European nations—England, France, Germany, and Italy in particular—as seemingly peculiar laws that govern libel, slander, public morals, and advertising are to blame. Exacerbating the situation are Americans and American corporations that use foreign venues to attack their competition.

For example, Coca-Cola has used European courts to stop Pepsi from using a series of humorous ads because they were unrealistic. The commercial in which M.C. Hammer turned into Perry Como after drinking a Coke, then turned back into a rapper after drinking a Pepsi, was declared illegal in Italy because it was misleading.

This kind of stupidity in Europe's apparently humorless court system is clearly outlined in an interesting article entitled, "Ice Patch on the Information Superhighway: Foreign Liability for Domestically Created Content." It appeared in a recent issue of the *Cardozo Arts & Entertainment Law Journal*, published by the Benjamin N. Cardozo School of Law at Yeshiva University. The author is Alex Gigante, the former chief counsel of Simon & Schuster, now with Putnam.

In this piece Gigante outlines specific problems with these European laws—not to mention the laws of South America, India, Africa, the Middle East, and Asia—which haven't caught up with the Internet. He wrote this article to promote a proposed "Convention on Trans-Frontier Computer-Network Communications," which would keep the Net from inevitable local censorship. I wish him luck. (For reprints, write Gigante at 75061.3624@compuserve.com, or view it at www.dvorak.org/gigante.)

It's laughable to imagine the Internet being open in tra-

ditional societies. The French, for example, think their culture must be protected from outside influences. (In fact, its culture is so strong it can barely be shaken.) This unrealistic self-assessment is the *good* news. But what can we expect when we look at authoritarian states such as Singa-

pore, or Communist countries such as China? Finally, there are Arab states where dissent is not tolerated and adoration of leaders is demanded by law.

What will happen is obvious. Let's go back to Europe and look at an interesting combination of two simple facts:

- The PTTs of Europe that control telecommunications have been looking for something to get involved with regarding the Internet.
- 75 percent of all intra-European traffic goes through Vienna, Virginia.

Obviously, it is cheaper to route locally than to send traffic across the Atlantic and back. Once the PTTs figure this out, they can effectively become serious network access points. Bureaucracies would be pleased, since the new job of Internet *Inspecteur Générale* would spawn thousands of professional surfers looking for objectionable content. Then, with blocking technologies and PTT-controlled domain-name servers, certain sites will simply become 404 (server not responding) errors. The average surfer will never know why. I don't see any way around this inevitable clampdown.

It's the ease with which the clampdown can take place that's ironic. Ironically, since the

hypergrowth of the Net in the U.S. allows other countries to use our infrastructure. This is what allows foreigners to set up unique local nets that can incorporate censorship. In essence, the U.S. has been the Internet lab for the entire world.

There is no doubt that the Internet—the Web in particular—will become a resource for much of the intellectual content of the world. But as the haves and have-nots continue to separate themselves in various ways, you can be certain that much of the world will not be included in the sphere of total access. The Web, for these people, will be hundreds of millions of pages of jazzed-up drivel, like most of the media worldwide. □



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Inside Track

Microsoft has said little about **Windows 97**, as beta testers from all over the world seem to have copies of it. The reason for the lack of hype is probably that Windows 97, although debugged, doesn't look much different from Windows 95. I'm guessing that cosmetic changes will be the last things to be added.

While on the subject of Microsoft, I've been extremely disappointed in Microsoft Outlook, which promised to be a killer PIM when first previewed. This again is more evidence to prove my thesis that company-orchestrated demos are useless and **should be avoided**. When Microsoft showed this program, it looked hot. I find it to be nothing less than **a slow pig**. I have never seen a program that takes so long to open and close, not to mention the long delays that occur when you're trying to perform simple tasks with the click of a mouse. I won't even discuss the **unnecessary complexity** and lack of a simple backup procedure. My recommendation to users of Schedule Plus and other PIMs: Outlook is **not recommended** as an upgrade. Sorry. I seldom reject products in this column, but I have a strong piece of advice for Microsoft: This thing needs a serious rewrite.

Bigger Is Better Dept.: The year of the 12-inch silicon wafer is about to commence as manufacturers move from the commonplace 8-inch wafer to **12 inchers**, which double the capacity of chip output on a per-wafer basis. The larger size may also reintroduce the concept of wafer-scale integration, where you put a slew of different chips on the same wafer and cut them out as one piece to be used together. Unfortunately, **growing the silicon** to a foot seems to be a problem. Apparently this is what hampered the transition to 12 inches last year. I find this interesting because one of the least reported functions of all of our space shuttle missions is to develop a crystal-growing operation in space. It's believed that crystals can balloon to **10 feet in diameter** or bigger under zero-gravity conditions, proving that objects made beyond the confines of the planet could be put to good use within them.

Apparently, 21 fabrication plants will go online by 1999 to handle the large wafers. The number of new fabs overall that are expected to come online in the next few years may be as high as 47. Dataquest analysts say the market can sustain only 33. The net result will be a glut of cheap chips. Sounds good to me!

Never Say Die Dept.: Every time an old technology is overshadowed by something new, the old technology somehow reinvents itself to compete better. This is

While I don't usually reject products in this column, here's my advice regarding

Outlook 97: Stay away!

I have a suggestion for Microsoft: This program needs a serious rewrite.

It is nothing less than a slow pig.

the case with those "supertwisted" flat-panel displays on laptops that simply do not look good compared with active-matrix screens. Apparently Hitachi may bring supertwist displays up to speed, making them competitive with active-matrix technology. This is important because the supertwist-nematic LCD is **a lot cheaper** to make. The new 12.1-inch screen will be called a Super Clear Color LCD. Hitachi hopes that when you see it, you'll think it's active-matrix.

Where, Oh Where Is My Cable Modem Dept.: Cable companies have finally decided on a cable modem standard. At the recent Cable '97 show, they anointed the Multimedia Cable Network Systems (MCNS) design for the down-

load part of the specification. But the upload side of the equation looks as if it's going to be **a phone line** in most situations. Such hybrid approaches remind me of those old simulcasts where you'd watch TV while listening to the stereo. It was just enough of **a hassle** to keep you from doing anything more than watching the TV broadcast alone. Unless there is some seamless software, I'd just as soon use the 33.6-Kbps modem and avoid sites that use a lot of multimedia.

Intel Is Intent on Putting TV on Your Computer Dept.: If you've followed Intel and its **crazed desire** to find a way to put video on the desktop, then you won't be surprised by its purchase of a large chunk of Avid, the premier professional video-editing equipment company. Intel wants to integrate Avid products into desktop systems. Keep in mind that Intel, with its Proshare products and special ISDN strategy, was one of the first to promote videoconferencing. If you've seen those recent Intel MMX commercials, note the emphasis on videoconferencing.

Intel is trying to force a technology into the minds of the populace, but the company should realize that even though both desktop video and voice recognition are functionally adequate, consumers have been **slow to move** to them.

I blame Apple for the snail's-pace acceptance of desktop video. When Apple was in a leadership role, it set what I call a **high standard of expectation**. For example, it added a mouse; therefore all computers built afterward were expected to have one. WYSIWYG, GUI, laser printers, and assorted fonts all derive from these guys. Apple added a microphone and sound and was about to put **a small video camera into the monitor case itself**.

Then it decided not to. If it had done so, we'd all be looking at one another. □

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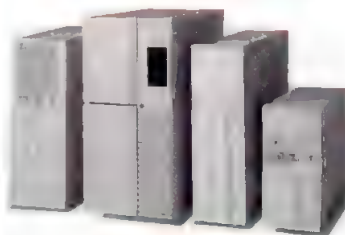
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Making Online Commerce Work

I've spent a lot of time over the past six months or so wrestling with two big issues for everyone who uses the World Wide Web: individual privacy and online commerce. There are powerful links between the two sets of problems, and important questions we need

to resolve for ourselves as individuals, as well as for our society. I can't fit discussions of both into one column, so I'm going to tackle online commerce this time and privacy in the next issue.

Electronic commerce is already a Big Deal—and is about to become a lot bigger. Estimates of the size of the electronic-commerce market today are all over the lot. The numbers I think feel right, from Forrester Research, put "e-mmerce" at about \$350 million for 1996 and forecast growth to about \$6 billion in the year 2000—which, please remember, is only two and a half years off. (Want bigger numbers? Help yourself: I've seen well-known consulting firms' estimates of electronic commerce in 2000 go as high as \$25 billion.)

Intelliquest, the market research firm whose numbers I trust most, says its surveys at the end of 1996 showed that the online commerce market is now much more like the U.S. population as a whole than before, split almost evenly between men and women. And Intelliquest's data shows that from April to November 1996, the number of people who had bought something online had increased from 9 to 15 percent of the Web-using population, which itself had grown over that period to 47 million.

So clearly electronic commerce isn't just coming, it's here *now*. And absolutely mainstream.

It is, however, a disorganized, chaotic, overhyped, and misreported phenomenon. That's not surprising, given the early stage of its development—and indeed, given the disorganized, chaotic, and overhyped world in which electronic commerce is being nurtured: the Web. But I've spoken over the past six months with a number of people who've come up with taxonomies of electronic commerce, structural hypotheses of how it works and could work better. I like their thinking.

These experts have come up with a remarkably consistent set of principles, or fundamental characteristics, that have to be in place for electronic commerce to succeed, attract repeat customers, and grow at the rates envisioned by those dazzling forecasts. These basic charac-

teristics are security, privacy, authenticity, and recourse.

In fact, there's nothing new about those elements of transactions: They were present in the bazaars of antiquity, and they're here to stay. When you came to my stall, you examined the goods closely, then paid me in your own goods or, later, some form of money we found mutually acceptable; we had a form of *security*. We engaged in an essentially *private* transaction, even if we were shouting at each other as we haggled, in the midst of tens or hundreds of others doing exactly the same thing. There was *authenticity*: I knew who you were, and you knew who I was. And as a buyer, you had *recourse*: If I cheated you, you knew where to find me.

In the global online village, it ain't so easy.

Bringing security to a transaction between the two of us is largely a technical problem. I need a secure Web server, and I need a way to authenticate the credit card number you put in, or the digital-cash account number you provide. Secure servers are commonplace, and credit card authorizations and digital-cash clearings are highly automated.

Privacy is a very different issue, with unexpected ramifications, twists, turns, and consequences. I'll save my thoughts about privacy for next time, but briefly, as an electronic-commerce customer you have to trust me: You're giving me the keys to your kingdom, in the credit card number, address, telephone number, and

other information you provide to persuade me to sell you something. What I do with that information is a big issue. How do you know you can trust me? Answers are emerging, but none are easy, and some will find them inadequate.

Authentication is tough. How, as a merchant, do I really know who you are? Did you find that credit card number on a discarded charge slip in a dumpster? Turning the tables, how do you know who I am? On the Web, my mail drop can be in East Lansing, Michigan; my server in Penang, Malaysia; my bank in the Cayman Islands. It can be very difficult for customers to be certain about whom they're dealing with. And even if I seem legiti-



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JIM SEYMOUR

mate, how do you know I'll deliver what I say I will—genuine Louis Vuitton luggage or a cheap knock-off? Or maybe nothing at all?

Finally, what about recourse? In my transnational example, if you feel treated unfairly, how do you track me down? Will the laws of whatever flag of convenience my corporate headquarters fly protect you? In the bazaar, you could find me in my stall, and if I weren't there, you could come to my home. What if you can't find where my money and I are really based—or even if you do, what if I'm far away, sheltered behind a legal system that takes *caveat emptor* literally?

I don't mean to sound pessimistic about electronic commerce; far from it, I'm a big believer in online buying, and as a *PC Magazine* reader, you may well be, too. We're probably both happy with the service we get from Amazon.com, with the boots we buy from L.L. Bean's site, and with those wonderful (if pricey) nippers from Garden Escape.

WEB PIONEERS

Sure, we're not typical. We're classic early-adopters, ready to try new things and take risks. But we can't form a nearly \$6 billion market in just two and a half years. Building mass markets demands mass participation, and the masses, as eagerly as they may be coming to the Web, aren't as trusting—or naive, as they might say—as you and I. We have to solve the problems of electronic commerce for *them*, or that mass market just won't develop.

I'm confident that the secure-systems problem is solved, though there are still a lot of potential Web buyers who are afraid of sending their credit card numbers over the Web. The credit card companies, worried that the digital-cash crowd will start stealing the transaction fees the credit card issuers believe are rightly theirs, will solve that through explicit guarantees against loss due to fraud. This will also help with the authenticity and recourse issues, though it won't completely solve either for merchant or buyer.

Privacy, I'm convinced, is the biggest hurdle we have to get past. If you're worried about what I'll do with the information you give me—if I hound you for additional purchases, sell the information indiscriminately (or maybe even discreetly), undermine your remaining shards of privacy in an increasingly unprivate world—you'll avoid the Web and just pick up the phone and call ol' L.L. Bean. Or Amazon. Or Garden Escape. More on privacy next time. □

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What's the Best CPU?

The choices in CPUs are getting to be overwhelming, frankly. There are half a dozen serious microprocessors you could choose from. Multiply that by two operating systems and you've got serious confusion, especially with the arrival of the Pentium II,

née Klamath. Here's my take on the chips you can buy for use in desktop and server PCs, ranked in order of increasing desirability.

• **Cyrix MediaGX.** This is the more-or-less Pentium/133 equivalent ticking away inside Compaq's low-end, sealed-box Presario 2100 (\$1,250 with monitor). The MediaGX integrates audio and video into the CPU core, but it is most definitely not an MMX or MMX-style chip.

We expect the Cyrix M2, due toward the latter part of this year, to be more competitive because of its MMX-style capabilities, but it's too early to tell.

• **Pentium.** The end is near for the classic Pentium: It tops out at 200 MHz. Anything faster will be a Pentium MMX chip. Buy systems with this chip if your company's motto is "We won't pay a lot for that muffler." Through year's end, if you want genuine Intel CPUs inside, this will be the cheapest way to go.

• **Pentium MMX.** Take the Pentium, add 57 multimedia instructions, and you've got the Pentium MMX (code-named P55C). A few applications take advantage of MMX today; many more will in the future. There will be some speed enhancements through the year, up to at least 233 MHz. You could run either Windows 95 or Windows NT on the MMX.

The mobile version of the Pentium MMX, with clock speeds from 133 MHz to 200 MHz, is the way to go if you're buying a notebook PC. Expect a 200-MHz or 233-MHz mobile chip later in the year.

This is the so-called Tillamook chip (yet another river in Oregon), the first to be built on a 0.25-micron fabrication process. Most CPUs now are 0.5, 0.35, or 0.28 microns. Making the chip smaller lets it (actually, requires it to) run at lower voltages and allows immense power savings.

• **Pentium Pro.** Originally called the P6, this chip offers a different architecture from the Pentium and Pentium MMX. It is the only Intel CPU that can be scaled to use four CPUs in one system unit, making the P6 the clear choice for high-end servers and for some very high-end workstations. The Pentium Pro currently goes to 200 MHz and carries up to 512K of internal L2 cache; we expect to see a 1MB (yes, 1

megabyte) internal L2 cache later this year. This is the CPU that most wants to be paired with Windows NT and true 32-bit Windows applications.

• **Pentium II.** Think of these just-shipped 233-MHz and 266-MHz chips (\$636 and \$775, respectively, in quantity) as each

being a Pentium Pro minus the on-chip L2 cache but with the 57 MMX instructions, all sealed inside a single-edge contact (SEC) cartridge the size of two cassette boxes laid end to end. The cartridge includes a 512K L2 cache, but it's external to the chip and runs at half the speed of a Pentium Pro L2 cache. Initial testing at PC Labs confirms Intel's claims that this chip is comfortable running both Windows 95 and NT. You should see an Alpha-like 300-MHz by this summer. For now, you can use two Pentium IIs in a single system but not four. Intel's next turn of the Pentium II chip set adds an Accelerated Graphics Port (AGP) for high-speed access to 3-D text maps, but you probably won't see AGP systems until early 1998. For most forward-looking Intel buyers, I believe Pentium II makes the most sense.

• **AMD K6.** K6 is the NexGen Nx686 design acquired last year when AMD found itself with a world-class wafer fab and no world-class AMD microprocessors. K6 is competitive with anything Intel ships currently—including the Pentium II. The K6 is available in 166-MHz, 200-MHz, and 233-MHz versions (\$244, \$349, and \$525, respectively), each with a 64K primary internal (L1) cache (Intel uses 16K or 32K

L1 caches). The K6 incorporates the MMX instructions, so it's most like the Pentium II in performance and possibly a bit faster on some operations, although not on floating-point-intensive applications. However, it's designed to slip into existing Pentium "Socket 7" sockets and to use existing Pentium motherboards. Couple that with a 25 percent cost advantage versus equivalent Pentium Pro or Pentium II CPUs and you've got a serious contender.

Intel never stands still, of course. But for now, K6 could be your best bet for the highest performance at a reasonable price. This is the most credible challenge we've seen to Intel hegemony since the early days of the PC. □



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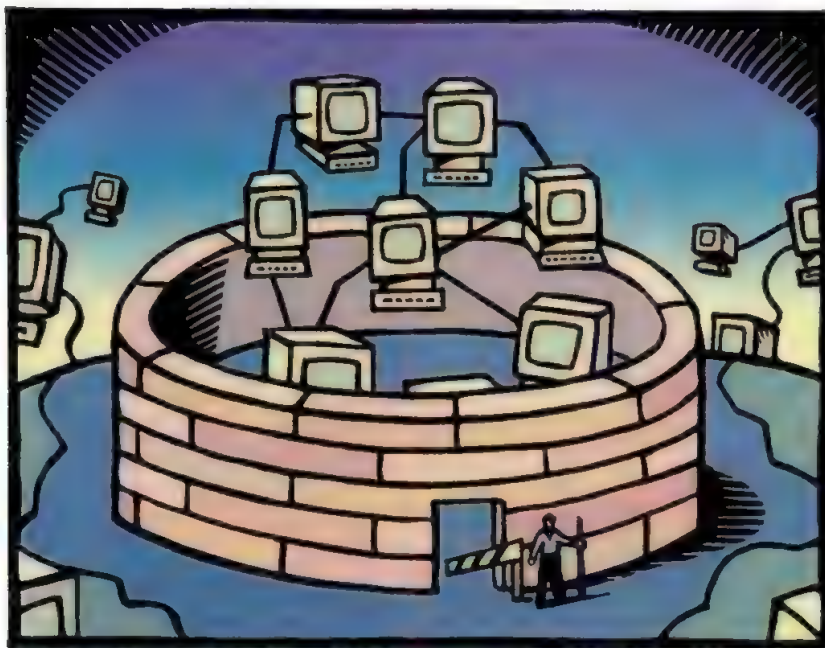
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NETWORK EDITION

INTERNET SECURITY

Disarming the Net

Connecting with the Internet brings a host of new security challenges to your corporate network. Here are some solutions.



By Leon Erlanger

The last two years have seen thousands of companies post Web sites and provide employees with Internet e-mail and browsing. As a result, any outsider with a little know-how and some malicious intent has a new way to infiltrate internal company systems and network devices: the Internet connection. Once inside, an intruder can find ways to snoop around; destroy, change, or steal data; and wreak havoc of various sorts. Even the most popular use of the Internet, e-mail, is inherently insecure: Anyone with a protocol analyzer and access to the routers and other network devices that handle e-mail as it travels from network to network across the Internet can

INSIDE



Network security is so vast a subject that it's almost impossible to understand completely. Hackers are always looking for new ways to intrude or wreak

havoc on corporate networks, and it seems as if every time one problem is solved several more pop up.

INTERNET CONNECTIONS have added a wide new avenue of entry into your corporate network. If you haven't connected your network to the Internet yet, you will. And when you do, there are lots of new security issues to tackle. In fact, there are so many that we've devoted this entire Network Edition to Internet security.

FIREWALLS are probably the first products that come to mind when you think of Internet security, but if you intend to make full use of the Net, firewalls are only a first step. In this Network Edition cover story, senior editor Leon Erlanger takes a comprehensive look at the issues and the products involved in securing your Internet connection—everything from firewalls to authentication, encryption, virtual private networks, and virus and Java protection.

INTERNET SECURITY product reviews are the focus of this month's First Looks. Contributing editor Steve Rigney puts two supposedly easy-to-use firewalls from ON Technology and Raptor Systems to the test. These firewalls are built for those who aren't security gurus but still need powerful protection. He also examines Webstalker Pro, one of the first products on the market that are specifically designed to protect your publicly accessible Web server from vandals. In addition, he also compares two products that can diagnose network security problems and tell you what to do about them.

—By Leon Erlanger

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3Com® OfficeConnect Hub 8/TPC	\$149
3Com OfficeConnect Switch 140	\$969
3Com OfficeConnect Remote 530 Access Router	\$1,099
APC Smart-UPS 700 with Power Chute plus software	\$389
Sony 4/8GB SCSI DDS-2 tape backup drive with tape (requires SCSI host adapter)	\$999
Seagate Backup Exec	\$249
Mylex dual channel Ultra SCSI-3 RAID caching controller with 4MB RAM	\$899

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NETWORK EDITION

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Meeting the Threats *Here are six common Internet security problems and their solutions.*



Interception of e-mail
Encrypt e-mail using desktop or server encryption hardware or software. Use digital signatures and certificates to authenticate senders and verify that e-mail has not been tampered with.



Theft or alteration of corporate information
Same procedures as for intrusion. Also use encryption hardware or software to encrypt traffic flowing from office to office across the Internet.



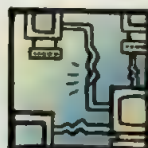
Macro viruses from e-mail attachments
Install an e-mail antivirus gateway to filter incoming e-mail messages.



Corporate network intrusion
Protect the perimeter with firewalls. If you want remote users to access sensitive internal data, set up an authentication server on the network and equip remote users with authentication tokens or smart cards.



Disruption of network devices and services
Protect the perimeter with firewalls. Set up an authentication server on the network and equip remote users with authentication tokens or smart cards.



Misbehaved Java and ActiveX applets
Configure firewalls to block Java and ActiveX applets, or install a Java and ActiveX gateway to filter out bad applets.

read and even change your messages unless you take specific measures to secure them.

As if that weren't enough of a security challenge, corporations are now eyeing the Internet infrastructure as an inexpensive vehicle for linking two or more geographically isolated LANs and for remote access connections. And widespread Internet commerce, requiring millions of secret transactions, may be just around the corner.

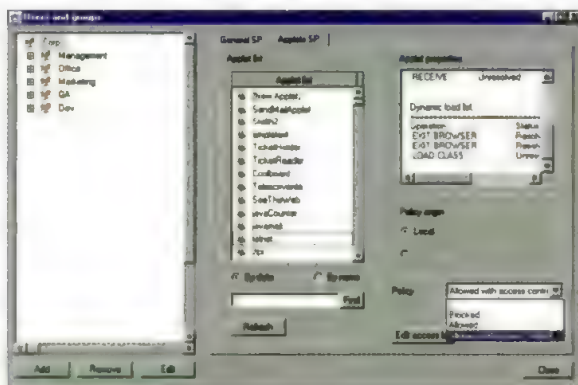
The network security market is responding quickly to the Internet challenge by adapting existing authentication and encryption technologies to Internet connections and by developing new security products. The market today is a mess of evolving standards, technologies, and products that solve one piece of the security puzzle or another but do not yet interoperate well. In this feature, we'll attempt to explain some of the trends that make up the security market. Check the First Looks section of this Network Edition for reviews of firewalls from ON Technology Corp. and Raptor Systems products from Internet Security Systems and Milkyway Networks Corp. that scan your network for security problems, and a Web server protection package from Haystack Labs.

SECURITY POLICY

Internet connections, like any type of connection, will never be 100 percent secure. Rather than aiming for total security, an organization has to assess the value of the information it is trying to protect and balance that against the likelihood of a security violation and the cost of implementing various security measures.

Your first step should be either to devise or to revise a comprehensive security policy

for your organization that takes Internet connections into account. This policy should define in detail which employees have rights to which services. It should also educate employees about their responsibilities for protecting the organization's information, such as protecting passwords, and clearly spell out actions that will be taken if a security violation is detected. Such a policy can serve as an invaluable tool for determining where to put your security dollars. *The Site Security*



FINJAN'S SURFINGATE lets you choose which applets your network users can download.

Handbook, written by the Network Working Group of the Internet Engineering Task Force or IETF (<http://ftp.ietf.org/internet-drafts/draft-ietf-ssh-handbook-04.txt>), offers a good overview of issues to consider in devising a security policy.

Part of the process will require evaluating the cost to the company of different types of security violations. You will want to involve people at the highest levels of your organization in this process. Hiring a computer security consultant may be in order. Many Internet service providers offer security consulting. Once you establish a policy, you should start evaluating the use of firewalls, encryption, and authentication.

FIREWALLS

Mention Internet security and most people start talking about firewalls. Firewalls aren't an Internet security cure-all, but they are essential to just about any Internet security strategy. For a comparison of Windows NT-based firewalls, see "Windows NT Firewalls Are Born," *Network Edition*, *PC Magazine*, February 4, 1997.

A firewall is simply a barrier between two networks—in most cases an internal network, often called the *trusted network*, and an external network, called the *untrusted network* (in this case, the Internet). Firewalls examine incoming and outgoing packets and, according to a set of rules defined by the administrator, either let them through or block them.

Today, most firewalls use one or more of three packet-screening methods. Many routers use a firewall technique called *packet filtering*, which examines the source and destination addresses and ports of incoming TCP and UDP packets and denies or allows packets to enter based on a set of predefined rules. Packet filters are inexpensive, are transparent to users, and have a negligible impact on network performance. Configuring packet filtering, however, is a relatively complex process. It usually requires precise knowledge of network, transport, and sometimes even application protocols.

Another problem with packet filters is that they're susceptible to *IP spoofing*, a trick that hackers use to gain access to a corporate network by changing *Internet Protocol (IP)* addresses in packet headers to ones that are acceptable.

A more sophisticated and secure type of firewall is an application gateway. Most ap-

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Internet Security Products

Company	Product Name	Network Operating System	Starting Price	Web Site	Phone
AUTHENTICATION SERVERS					
Hewlett-Packard Co.	ImagineCard	Unix	\$60/\$250 per user	www.hp.com	800-637-7740
Secure Computing Corp.	SafeWord	Unix	\$1,875 for 10 users	www.securecomputing.com	800-808-1111
Security Dynamics	ACE/Server	Unix; Windows NT	\$2,450 for 10 users (tokens, \$60 each)	www.securid.com	800-732-8743
DIGITAL CERTIFICATE SERVERS					
Netscape Communications Corp.	Netscape Certificate Server	Unix; Windows NT	\$395	home.netscape.com	415-937-2555
Xcert Software Inc.	Sentry CA	Unix	\$1,495	www.xcert.com	604-640-6210
ENCRYPTION HARDWARE					
RedCreek Communications Inc.	Ravlin 4 (4 Mbps); Ravlin 10 (10 Mbps)	Proprietary	\$1,300 (Ravlin 4); \$3,500 (Ravlin 10)	www.redcreek.com	510-745-3900
TimeStep Corp.	Permit Security IntraGate	Proprietary	\$2,295	www.timestep.com	800-383-8211
VPN Technologies Inc.	VSU-1000	Proprietary	\$3,995	www.vpnet.com	408-445-6600
FIREWALL SOFTWARE					
Check Point Software	Check Point FireWall-1	Unix; Windows NT	\$2,995 for 25 nodes	www.checkpoint.com	800-429-4391
Milkyway Networks Corp.	SecureIT Firewall	Unix	\$2,900 for 10 users	www.milkyway.com	800-206-0922
ON Technology Corp.	ON Guard Firewall	Proprietary	\$5,495 for 100 users	www.on.com	800-767-6683
Raptor Systems Inc.	Eagle NT Firewall (Windows NT) Eagle Firewall (Unix)	Unix; Windows NT	\$6,500 for 50 users (NT); \$7,000 for 50 users (Unix)	www.raptor.com	800-932-4536
Secure Computing Corp.	Secure Computing Firewall for NT	Windows NT	\$3,850 for 50 users	www.securecomputing.com	800-808-1111
Trusted Information Systems	Gauntlet Internet Firewall	Unix; Windows NT	\$5,000 for 50 users (NT); \$11,500 (Unix)	www.tis.com	1-800-firewall

plication-gateway firewall products, including Raptor's popular Eagle line and Trusted Information Systems' Gauntlet, use application proxies. These are programs written for specific Internet services, such as HTTP, FTP, and telnet, that run on a server with two network connections, acting as a server to the application client and as a client to the application server.

Since they evaluate network packets for valid application-specific data, application proxies are generally considered more secure than packet filters. Most application-gateway firewalls also have a feature called *network address translation* that prevents internal IP addresses from appearing to users outside the trusted network.

One primary disadvantage of application gateways is performance degradation caused by the proxy function's double processing. Another is the fact that you may have to wait several months for your firewall vendor to supply an application proxy for a newly introduced Internet service, such as RealAudio. If you plan to use a firewall solely as a perimeter defense behind a T1 connection to your ISP, you may not have to worry about performance; the low bandwidth of the connection will become saturated before the firewall.

Many organizations, however, will want to consider using additional firewalls internally to cordon off servers in departments, such as Human Resources, that contain sensitive information. In such cases, performance is a concern, because the connection is likely to be 10-Mbps Ethernet or 100-Mbps Fast Ethernet. If you plan to use application proxies internally, consider a fast hardware-based solution, such as Cisco's



SECURITY DYNAMICS' Secure 10 tokens come in several form factors, but all use pass codes that change over time.

PIX Firewall or Seattle Software's Firebox. Or you may consider installing your firewall software on a system with multiple processors.

A third type of firewall technology, termed *stateful inspection* by Check Point Software Technologies, is in Check Point's Firewall-1, Cisco's PIX Firewall, ON Technology's ON Guard, and Network-1's Firewall/Plus. Like packet filtering, it first intercepts packets at the network layer, but then it inspects entire packets, comparing them against known bit patterns (states) of friendly packets. Stateful inspection generally results in slightly higher performance than application proxies, but debate remains as to whether it is as secure or marginally less secure. On our tests, we haven't seen any difference in security between the two models.

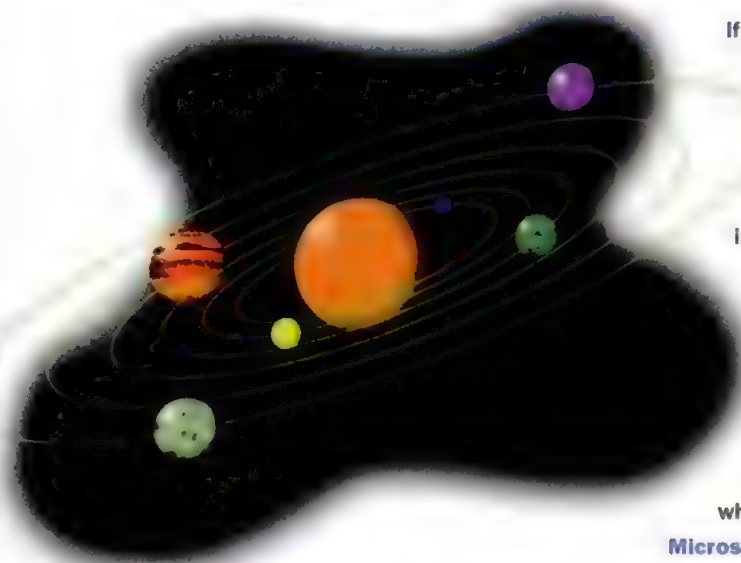
Initially, most firewalls were written for Unix, but last year saw a flood of new Windows NT-based firewall products from vendors, including Check Point, Raptor, Seattle Software Labs, and Trusted Information Systems. If you're comfortable with Unix, a Unix-based firewall gives you the advantage of an operating system that has been around long enough for many security problems to be found and dealt with. If you are more comfortable in the Windows world, however, stick with a Windows NT-based firewall, since security violations are more likely to come from



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errors in firewall configuration problems with generating system. The major rated address their 0.0.0.63 0.0.0.255 0.0.0.63 0.0.255.255 255.255.255.255 0.0.0.0 0.0.255.255 FFFFFFFF.0000.0000.0000 0.FFFF.FFFF.FFFF FFFFFFFF.0000.0000.0000 0.FFFF.FFFF.FFFF

STERS PROVIDE packet-filtering firewalls, but configuring them can be complicated.

Internet security solutions. Most of these features will be discussed below. They include encryption, authentication, antivirus protection, protection from misbehaved Java and ActiveX downloads, and even server load balancing. If you're just starting out, see where your vendor is going in terms of offering a complete security solution.

In most cases, your publicly accessible Web servers will sit outside the firewall. Though you may not want to restrict access to Web server information, you will want to prevent tampering with the Web server content itself. Trusted Information Systems' Gauntlet ForceField and Haystack Labs' WebStalker, reviewed in First Looks, are products that concentrate on Web server protection, providing authentication as well as monitoring and alarms for unauthorized activities.

AUTHENTICATION

Firewalls do their authentication using IP addresses which are assigned to each server, client, and network device and can be spoofed. So if you want to give certain users access over the Internet to sensitive internal files and data, you'll want to make sure to authenticate the actual user.

Authentication simply describes the numerous methods that positively identify a user. Passwords are the most common method of authentication used today, but users are notorious for making poor password choices that can be guessed by an experienced hacker.

In addition to passwords, which are often called "something you know," many organizations are turning to solutions that also require "something you have," such as tokens and smart cards. Tokens are small,

credit card- or calculator-size devices that the remote user carries around.

Many of these products use a challenge-response scheme. When the user attempts to connect, an authentication server on the network issues a challenge, which the user keys into the token device. The device displays the appropriate

response, which the remote user then sends to the server. Many of these tokens also require the user to type in a PIN. Tokens range from \$35 to \$65 each, depending on volume. Less expensive software versions of tokens are available.

The market leader in token technology is Security Dynamics, with its SecurID line of token products and ACE/Server. SecurID products are supported by several firewall products, including those from Check Point, Raptor, and Trusted Information Systems. You simply configure the firewall products to forward authentication for certain services to the designated third-party server, or use any included authentication service.

Smart cards used for authentication are similar to tokens, except they require a smart card reader to process the challenge. Though these devices have shrunk in size over the past few years, they're still additional devices that the user has to carry and can find cumbersome. They are also generally more expensive than tokens, ranging in price from \$40 to \$250 per user. Gemplus and SCM Microsystems are two manufacturers of smart card readers. PC Card devices are also available but more expensive.

Digital certificates, described in the following encryption discussion, are an up-and-coming authentication method that holds great promise for messaging and electronic commerce.

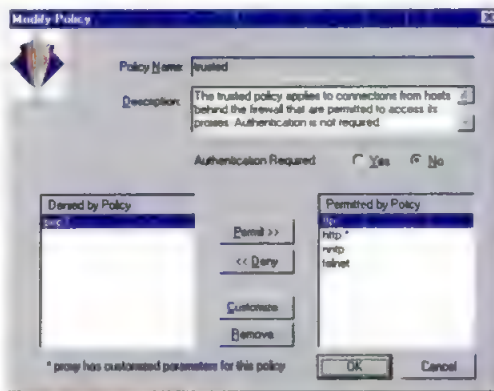
ENCRYPTION

As offices and organizations have connected to the Net in droves, many have begun eyeing the Internet infrastructure as an inexpensive vehicle for wide-area and remote connections. To use the Internet for these purposes, however, companies have to protect their information with **encryption**. Encryption is simply the process of using a for-

mula, called an **encryption algorithm**, to translate plain text into an incomprehensible cipher text and then back to plain text again. Essential to encryption is a numeric value called the **key** that becomes part of the encryption algorithm, setting the encryption process in motion.

Many different types of encryption algorithms are available, but the most widely used are DES, a **symmetric** or **secret key** algorithm, and RSA, an **asymmetric** or **public key** algorithm. DES can be used with 40- or 56-bit keys. RSA's key lengths are generally anywhere from 512 to 2,048 bits. A more recent algorithm called Triple DES is a stronger version of DES that uses more than one key.

S/MIME is an up-and-coming standard for securing e-mail that uses RSA encryption. Microsoft, Netscape, Novell, and Sun all either presently support or have plans to support S/MIME in their messaging systems. This will allow the messaging systems to send secure e-mail to each other. They can also address several desktop e-mail encryption packages, including ConnectSoft's EMail Connection, OpenSoft's ExpressMail, and Deming Internet



WITH THEIR EASY-TO-USE interfaces, Windows-based firewalls help you avoid configuration errors.

Security's Secure Messenger, support S/MIME. For reviews of the desktop packages, see "Internet E-Mail Encryption," *PC Magazine*, April 8, 1997.

With a symmetric or secret key algorithm such as DES, the same key is used for encryption and decryption. This technology requires significantly less processing power than asymmetric key encryption. Secret key encryption, however, requires a separate key for each pair of users exchanging information—a significant management burden. It also requires secure establishment and distribution of the secret keys. This is a difficult task in an open environment like the Internet.

RSA's asymmetric encryption uses two

separate keys. Each participant in an encrypted transaction has one private key, known only to that person, and one public key, which can be seen by anyone. The same key can't be used for both encryption and decryption. If you need to send me text, I can send you my public key, which you can use to encrypt the text, but only I will be able to decrypt it using my private key.

The advantage here is fewer keys to manage. But RSA requires lots of processing power, resulting in poor performance. So today, most encrypted trans-

actions use symmetric keys to encrypt and decrypt the text or transaction. But then that encrypted text is sent to the other party along with the secret key, which itself is encrypted and decrypted using asymmetric RSA encryption.

This combined method of encryption not only assures data privacy, it also enables an authentication mechanism called the *digital signature*. Any value encrypted using the sender's private key authenticates the sender. Any data decrypted using the recipient's private key authenticates the recipient.

Public keys are generally authenticated with *digital certificates*, which accompany transactions and are signed by a *certificate authority*. A certificate authority, officially linking a public key to the user, can exist in an organization using digital certificates internally and with trusted business partners. Netscape and Xcert offer certificate servers for managing digital certificates. The certificate authority can also be a trusted party among a community of users, or it can be a larger, more public entity such as GTE, Nortel, or Verisign—well known for their stringent processes to verify identities and assign digital certificates. X.509 is the most widely used industry standard for defining digital certificates. Digital certificates will be one of the primary security techniques used in the credit card and digital cash transactions common in electronic commerce.

Secure Sockets Layer (SSL) is a transport-layer technology developed by Netscape to allow secure transactions between compliant browsers and servers—usually Web servers. The leading browsers from Microsoft and Netscape support SSL, as do



REDCREEK COMMUNICATIONS' Ravlin 4 and Ravlin 10 provide fast encryption and key management for VPN.

many Web servers. SSL uses RSA digital signature algorithms and can use X.509 certificates and several secret key encryption algorithms such as DES and Triple DES.

Ultimately, encryption will become integrated in systems and networks. It will be built into IPv6, the next generation of IP, currently being developed by the IETF. On the hardware side, Intel is currently working on an encryption coprocessor for incorporation onto the motherboards of PCs and servers.

VIRTUAL PRIVATE NETWORKS

Virtual private networking (VPN) is the term used to describe remote access over the Internet, as well as use of the Internet infrastructure for connecting two offices of an organization or even two different organizations. Several firewall products provide VPN capability, including Checkpoint's Firewall-1 and Raptor's Eagle line, as well as Seattle Software Labs' Watchguard Security System 200, Network-1's Firewall/Plus, and Trusted Information Systems' Gauntlet.

With remote access, the remote user calls the local ISP, then connects to the central network over the Internet. Two industry standards have recently become interoperable to make remote access and connections over virtual private networks a viable strategy—Ascends' and Microsoft's *Point-to-Point Tunneling Protocol* and Cisco's *Layer Two Forwarding (L2F)*, now combined by the IETF to form the *Layer Two Tunneling Protocol (L2TP)*. This standard essentially allows the authentication and authorization process to be forwarded from the ISP to a server located elsewhere on the Internet—at a cor-

porate cen-

Another...
oped by the...
IPsec or *Secure*...
products that sup-
communicate public key
rithms with each othe
sions. Again, most V.
firewalls supporting VPN
IPsec. Remember, though,
ability testing has just begun and
is still in the works.

VPN, and any encryption for...
ter, is very CPU-intensive and can...
performance problems if not properly...
dled. You'll want to do some preliminary...
testing with any encryption product and...
build a system that has the CPU power to...
support it. You may also want to consider...
using a fast, dedicated hardware solution...
for building a VPN, such as those offered...
by DSN Technologies, Information Re-
source Engineering, RedCreek Commu-
nications, and VPNet. Several of the so-
lutions are available for both network...
connections and the mobile user. Many of...
these devices handle key management au-
tomatically. Prices range from \$1,300 to...
\$6,000 and up.

OTHER THREATS

Even after you've done all you can to block unauthorized users from accessing your network, there is still the danger of viruses, which can enter through e-mail attachments, and misbehaved Java and ActiveX applications that come into your network as your users browse the Net. In "First Line of Defense," Network Edition, April 8, 1997, we looked at products that examine your incoming e-mail for macro viruses. Check Point has announced plans to incorporate this technology into its firewall products.

As for dealing with Java and ActiveX, Finjan Software offers SurfinShield Xtra for desktop users as well as SurfinGate for your servers. These unique packages actually maintain a database of known Java and ActiveX problems and monitor your incoming and existing applets. Both products block only applets that misbehave, letting all others through.

Internet security, like network security, is still in its infancy. Today, firewall vendors are leading the charge in providing other pieces of the Internet security puzzle—either by adding them themselves or by partnering with other vendors and supporting third-party products. The next two years or so should definitely see security-related standards finalized and Internet security solutions consolidated. □

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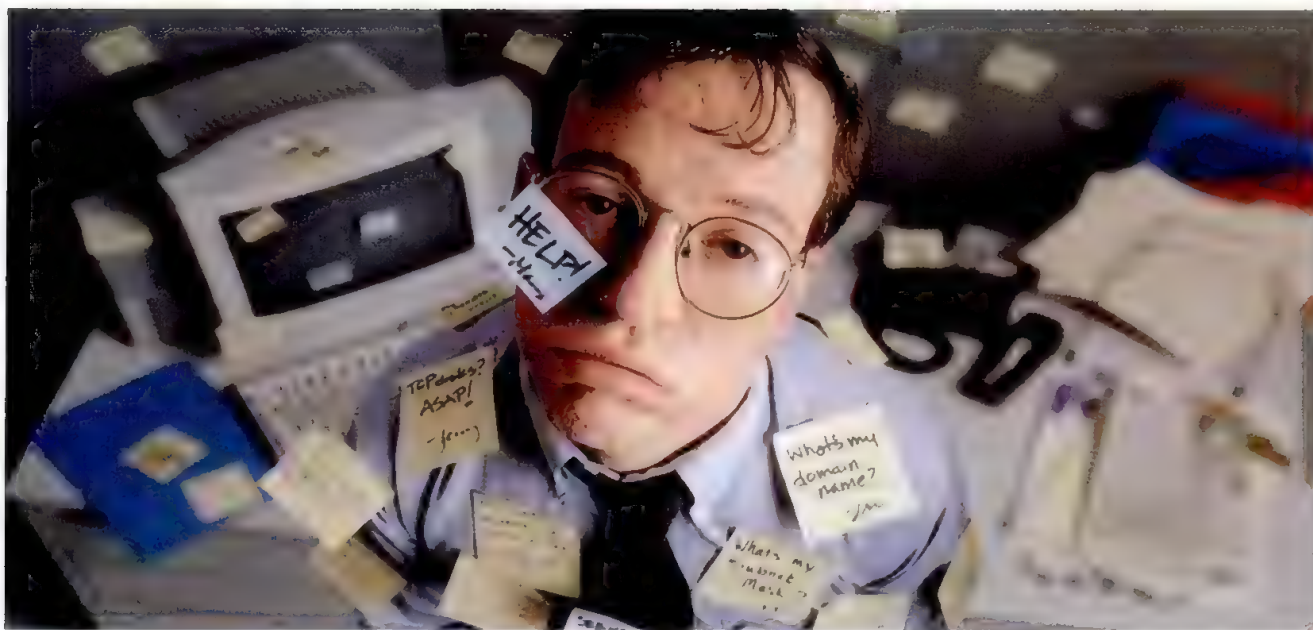
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Source: KeyLabs, Inc., February 1997

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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

SECURITY AUDITING TOOLS

Network SAFETY

By Steve Rigney

Designed to test your security implementation for protection against inside and outside attacks, Internet Security Systems' SAFEsuite Internet Scanner for Windows NT (\$995 for 10 IP addresses) looks for hundreds of vulnerabilities, provides a list of possible holes, and even suggests corrective actions. The product comes with an attractive interface and is fairly easy to use, as long as you have a good understanding of TCP/IP services and how they work.

SAFEsuite has three components: the Intranet Scanner, Firewall Scanner, and Web Scanner. The program runs on a single PC loaded with Windows NT 3.51 or 4.0 and comes with a license key based on a single range of IP addresses. If you want to scan multiple networks or segments, you'll need multiple licenses.

SAFEsuite's battery of tests covers known weak spots that internal or external hackers can exploit. Since new holes are constantly being discovered, the folks at ISS are always updating their product. For an additional 20 percent of the license fee, you can receive all updates.

Each of the tests comes with three different settings: light, medium, and heavy scan. The light scan looks at the basic vul-

nerabilities on your network, such as shared resources without passwords, and requires only a few minutes to run. The medium scan looks for the same holes as the light scan, plus a few more. For example, in a light scan of FTP, the test looks for just anonymous connections. A medium scan looks for anonymous and trivial FTP

two client PCs running Windows 95, the scan required about five minutes per PC for the light scan, and 20 minutes per PC for the heavy scan.

The Intranet Scanner, designed to test all of the servers and hosts on your internal network, looks for more than 120 security vulnerabilities in services such as e-mail, FTP, Network File System, and NNTP (Newsgroups). For example, the Intranet scan will look at your FTP servers to see if anonymous access is allowed and alert you to the condition. It also checks all of your Windows NT servers, Windows 95 clients, routers, and X-Terminal consoles for holes.

The Intranet Scanner also includes the Brute Force and Denial of Services scans. Brute Force attempts to find default accounts using passwords that could be guessed, much in the same way a hacker does. A good example of a default account is the Administrator user name for Windows NT and the Sync log-on for some Unix operating system. Though the Sync log-on, which usually provides only version information, may seem harmless, some FTP programs allow you to log on as sync and steal the password file.

The Denial of Service scan looks for any vulnerabilities that would allow an intruder to bring your system to a crawl or even shut down your server using tricks like Finger and Ping bombs, Data floods, Log floods, or

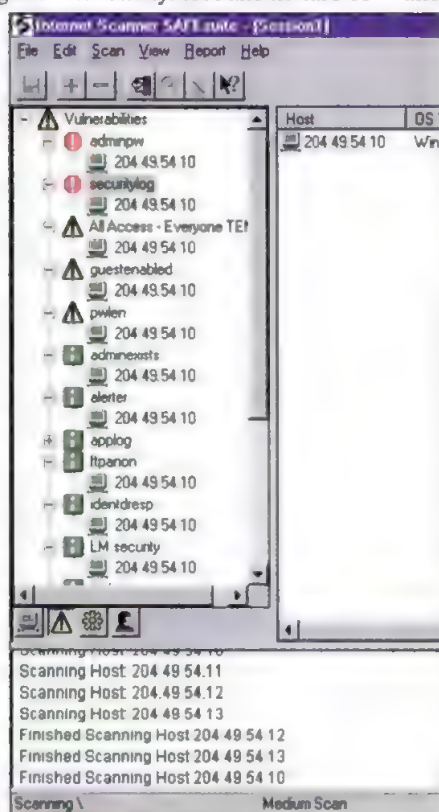
SYN storms. You'll want to run this scan overnight or during the weekend, since the object of the test is to bring the server down.

The Web Security Scanner tests not only your Web server for more than 100 known holes but looks for any holes in the underlying operating system. It also checks for known problems with certain Web servers, such as Microsoft IIS. Versions of IIS before 2.0 had a command bug that would allow users to run programs on the server that could crash the server.

One of the most important tests is the Firewall Scanner, which looks for more than 100 holes that an intruder could use to access your internal LAN. The most common attacks include IP Spoofing, source routing, and SOCKS—a proxy security service with known vulnerabilities. Like the Intranet Scanner, the Firewall Scanner also provides Brute Force and Denial of Service scans.

After you run all of the scans, SAFEsuite creates an HTML-based report listing the results by level of importance and even provides you with some ideas of how to correct the problem. Though the product is extremely powerful, it does take a few days to understand all of the different scans and to configure the proper test for your network. If you use SAFEsuite on a frequent basis, you should have a pretty secure network that will block intruders.

SAFEsuite Internet Scanner for Windows NT. List price: For 10 IP addresses, \$995. Internet Security Systems, Atlanta; 770-395-0150; fax, 770-395-1972; www.iss.net. Circle 954 on reader service card.



ALL IS SAFE: SAFEsuite's main menu lists all the available network hosts you can scan.

connections. The heavy scan looks for all vulnerabilities and requires the most time. In our test on a Windows NT network with a firewall, Web server, and

NETWORK EDITION

First Looks

SECURITY AUDITING TOOLS

An Audit You're Sure to Like

By Steve Rigney

If you don't know there's a hole in your network, then you sure can't fix it. SecurIT Audit (\$1,495 for software and class C license), from Milkyway Networks Corp., can help you not only find the holes but, like ISS's SAFEsuite, tell you how to fix them. The product, which runs on a Sun SparcStation 5 or higher workstation with at least 48MB of RAM, can scan all your network devices, including firewalls, mail servers, Unix

provide individual addresses if you just want to scan a single PC. The probe operation is slow, however. On our tests, it took up to 10 minutes per host. Milkyway Networks plans to correct this in future versions. You can use the probe feature to create an inventory of network hardware as well.

To perform scans, Audit uses scenarios, which you create from a graphical interface. Each scenario includes specific host addresses and the type of

common root passwords. The Denial of Service scan determines how much traffic and hacking your servers can take. It attempts to break into your system or, at least, take it offline, by performing operations such as SYN floods, Ping-death, and Finger bombs.

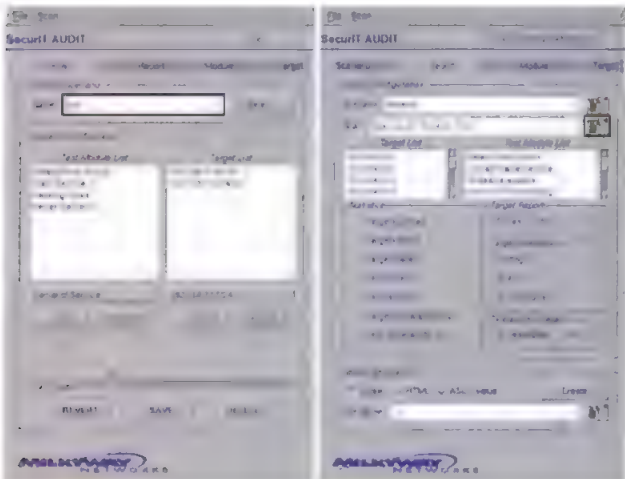
SecurIT Audit doesn't report, however, on the Denial of Service test results. The only way to determine your servers' vulnerabilities is to monitor whether they crash or not. The Firewall scan is the most robust and includes all the tests in the Denial of Service, Generic, Windows NT, and Unix scans, plus tests for firewall-specific holes.

After each scenario scan is finished, results are posted in a report database. You can view the reports on screen, convert

them to HTML, or save them to an ASCII file. The report lists all the devices that were scanned as well as any vulnerability found. You can also customize the reports and save them for future use.

In addition to viewing the problems a test finds, you can have the report list an appropriate fix. The product even lists related Computer Emergency Response Team (CERT) and the U.S. Department of Energy Computer Incident Advisory Capability (CIAC) documents and their URLs.

SecurIT Audit. List price: For software and class C license, \$1,495. Milkyway Networks Corp., Ontario, Canada; 613-596-5549; fax, 613-596-5615; www.milkyway.com. Circle 955 on reader service card.



SECURE REPORT: Results from SecurIT Audit scans, which are based on scenarios you create, are posted for you in a report database.

hosts, and Windows NT- and Windows 95-based PCs. And SecurIT Audit can check for vulnerabilities on several platforms, including Linux, Solaris, SunOS, and Windows NT and Windows 95.

SecurIT Audit is extremely easy to install, though you'll need some Unix knowledge. It's also part of a larger family of Milkyway Networks products that includes SecurIT Access and Firewall.

The probe feature is one of SecurIT Audit's most robust. It lets you insert a range of IP addresses, and the product then automatically scans for security holes in devices using any address in the range. You can also

scan you want to run. The product includes five scan types: Generic, Windows NT, Firewall, Unix, and Denial of Service. These scans are constantly updated, and you can download new modules from Milkyway Networks for \$995 a year. You can also mix and match different scans.

The Generic scans for multiple holes in services. The Windows NT includes all the Generic tests, plus those for Microsoft IIS and Windows NT and Windows 95 Web servers. The Unix combines the Generic scans with other tests for dozens of Unix-specific vulnerabilities, including default user accounts, Sendmail holes, and

FIREWALLS

Firewalls Made Friendly

By Steve Rigney

Up to this point, the rule has been that firewalls are hard to install and even harder to configure. But that rule is being rewritten with the introduction of ON Guard, from ON Technology Corp., and The Wall, from Raptor Systems. Designed for people who don't know firewalls yet need powerful protection, these products are easier to install and maintain than the usual firewall fare.

Though similar in terms of ease of use, these products differ in approach. ON Guard uses Stateful Inspection Layer Technology, a combination of packet- and application-level filtering. The Wall uses the classic application-level technique. Of the two, ON Guard is more expensive, but at that price you get more flexibility and support for unlimited IP addresses.

We recommend The Wall for small businesses that only want to block outside access. For handling almost any business security needs, consider ON Guard.

ON Technology Corp.

ON Guard

Protecting your network from all the old hacker tricks is easier—and cheaper—with ON Technology Corp.'s ON Guard. At \$1,495 for the minimum hardware configuration and \$5,495 for 100 IP addresses, this hardware/software combination actually makes the usually arduous process of installing firewalls easy. Designed for administrators who aren't security gurus and don't want to be, ON Guard includes dozens of services, powerful event logging, and a utility that tests your security plan. It is also one of the few firewalls currently on the market that can block both IP and IPX network packets.

We tested ON Guard on a 486-based Hewlett Packard Vectra with two 3Com network adapters. If you already have a 486-based PC sitting around and want to build your own firewall, ON Technology will provide you with the fire-



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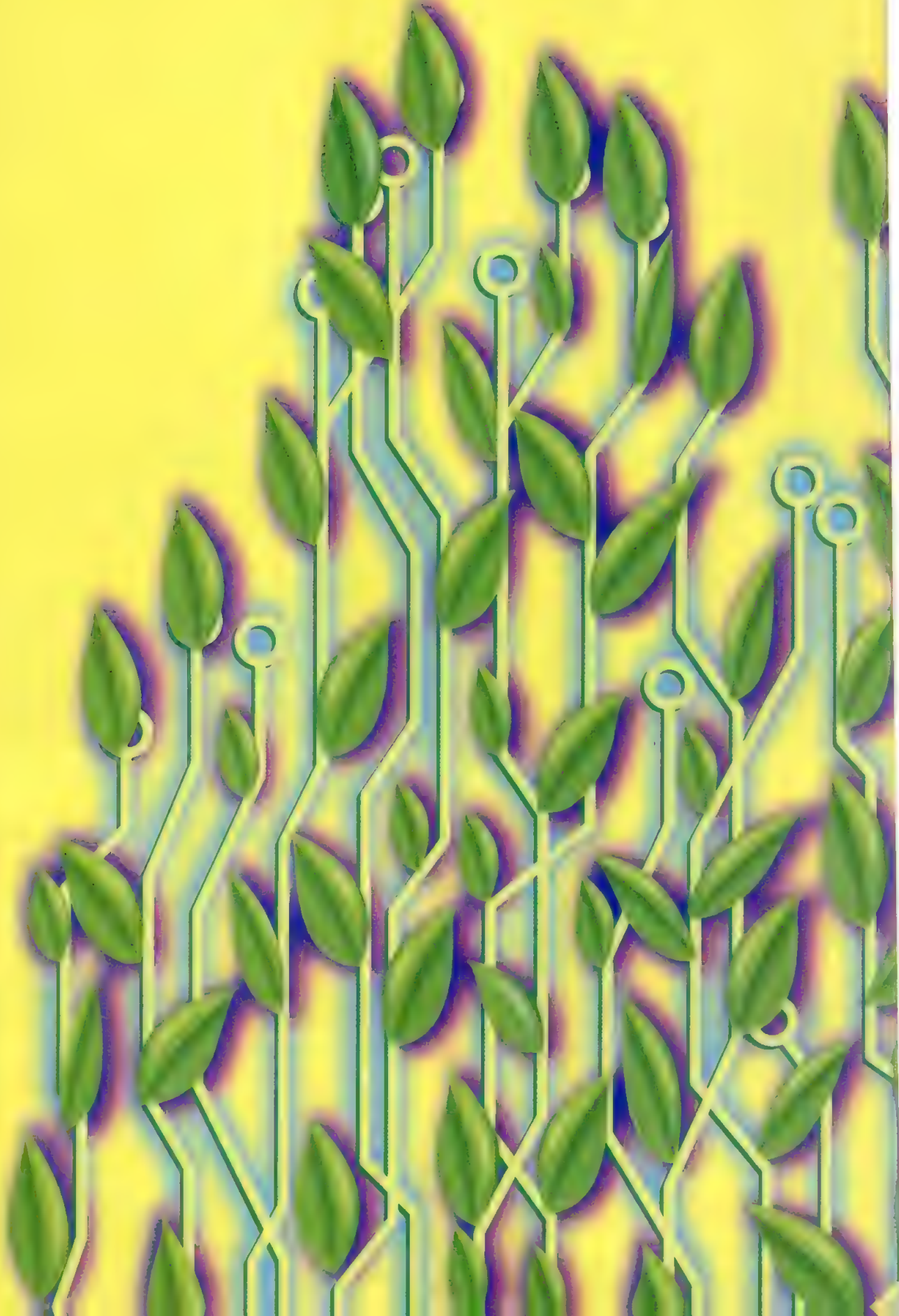
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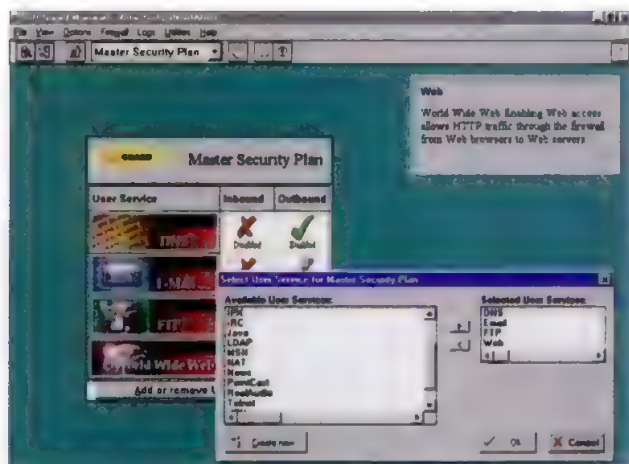
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NETWORK EDITION

First Looks



STAND GUARD: ON Technology's ON Guard allows you to disable Internet services easily.

wall operating system, Secure3OS, for the purchase of a license token.

Though ON Guard isn't as easy to install as The Wall, we had our test unit up and running in 15 minutes. An installation wizard walks you through each step, including connecting the firewall to your LAN. And you can install and configure ON Guard from a remote PC.

Like Check Point Software's Check Point FireWall-1, ON Guard uses Stateful Multi-Layer Inspection (SMLI) technology, a hybrid of packet- and application-level filtering. Unlike application-level filtering, SMLI doesn't require separate software to block each new Internet services, such as Point-Cast and RealAudio. This is advantageous, because you don't have to wait for ON Technology to provide software to block these services. The firewall can already handle them.

Unlike The Wall, with which services are either enabled or disabled, ON Guard allows you to customize multiple services. The program disables Web, e-mail, and FTP access by default. But you can enable these services and others, such as Java, RealAudio, and newsgroups, and you can also create access rules for users based on IP address. Once a service is in the list, you can enable or dis-

able access for both inbound and outbound traffic.

You can also control access to subservices, such as POP and SMTP for e-mail, for the services listed above. If you aren't familiar with how these work, however, you probably shouldn't change them.

ON Guard, like The Wall, provides detailed logs of major events that take place on the firewall. It can send an SNMP alert to a management station or launch a third-party program when a problem occurs. It doesn't send out an e-mail alert, however.

In addition to ease of use, ON Technology adds potential value to the firewall with its optional modules. The encryption module (\$1,995 for 100 IP addresses) lets you create a virtual private network between two ON Guard firewalls. The Address Translation module (\$995 for 100 IP addresses) lets you configure your network so that internal IP addresses appear as a single address from outside the network. This prevents outsiders from seeing the IP addresses inside the firewall.

ON Guard. List price: For 100 IP addresses, \$5,495. ON Technology Corp., Cambridge, MA; 800-548-8871, 617-374-1400; fax, 617-374-1433; www.on.com. Circle 951 on reader service card.

Raptor Systems Inc.

The Wall

If you're operating a small network and want to enable Internet access, you may be worried about the inherent security risks of doing so and the cost of protecting yourself. Consider Raptor Systems' The Wall (\$995 list), a firewall that should fit both your pocketbook and your level of security expertise. Easier to install than most word processors, The Wall runs on a Windows NT Server and Workstation 4.0 and includes powerful logging capabilities. In addition, its built-in WebNOT utility lets you block access to 15,000 unsavory Web sites.

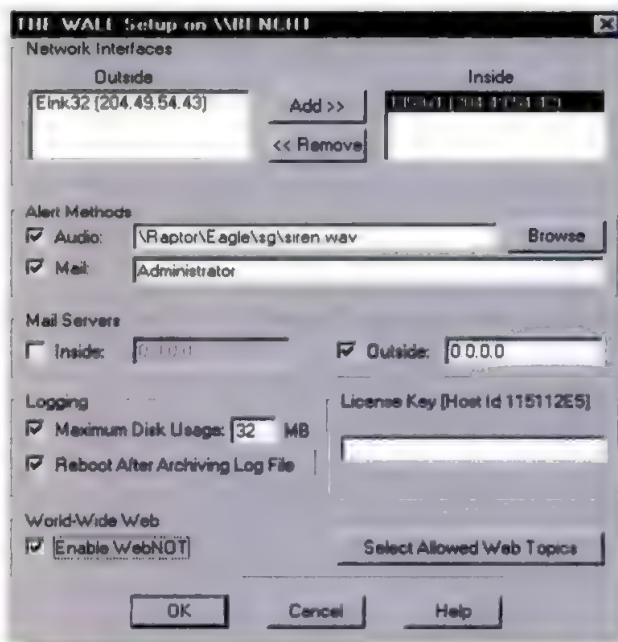
The Wall is limited to 25 users and can only block external attempts to access your LAN. Ex-

cept for WebNOT, it doesn't give you control over the Internet services your internal users access. Expected later this year, an enhanced version of this product will support more users, include a Web server, and provide more configuration options.

A low price and three-step installation make The Wall appealing to small businesses. All you need to provide is the IP address of each network adapter, your e-mail server's address, and the validation key. The Wall does the rest, including disabling network services on your Windows NT PC that might leave holes in your protection.

Like ON Guard, The Wall disables all outside access by default. When you first install the product, no one can access your LAN. You can enable e-mail, FTP, and Web access for remote users.

Unlike ON Guard, which uses SMLI, The Wall is an application-level firewall that uses proxy servers to protect your network from the Internet. These firewalls have two network adapters to shield you. One connects to your LAN, and the other to a router or



EASY TO BUILD: You only have to provide basic information to get The Wall up and running.

other Internet connection. Application-level firewall: capture every internal Internet request. The proxy server looks at the request and, if the user has permission, sends it to the host, such as a Web or FTP server using the outside adapter. The proxy then examines the response from the host before sending it to the user who

captured the request. The proxy server looks at the request and, if the user has permission, sends it to the host, such as a Web or FTP server using the outside adapter. The proxy then examines the response from the host before sending it to the user who

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NETWORK EDITION

First Looks

made the request. This prevents internal users from connecting to the Internet and outsiders from connecting to your LAN without permission.

A well-designed firewall should prevent intruders from penetrating your network, but you will want to know if someone tries or succeeds in doing so. The Wall addresses this concern with its extensive event logs. These logs will tell you if an external user tries to connect to your network, when an internal user tries to connect to the Internet, what configuration problems come up with the firewall software, and what the

firewall's routine functions are.

At midnight each day, The Wall saves the log files labeled with the date. You can also configure The Wall to send two types of intruder notification—audio and e-mail—when it logs a message that might need attention. Another advantage is a Raptor Systems subscription (\$600 list for the first year and \$150 list for subsequent years), permitting you to add new sites to WebNOT.

The Wall. List price: \$995. Raptor Systems Inc., Waltham, MA; 617-487-7700; fax, 617-487-6755; www.raptor.com. Circle 952 on reader service card.

SERVER SECURITY TOOLS

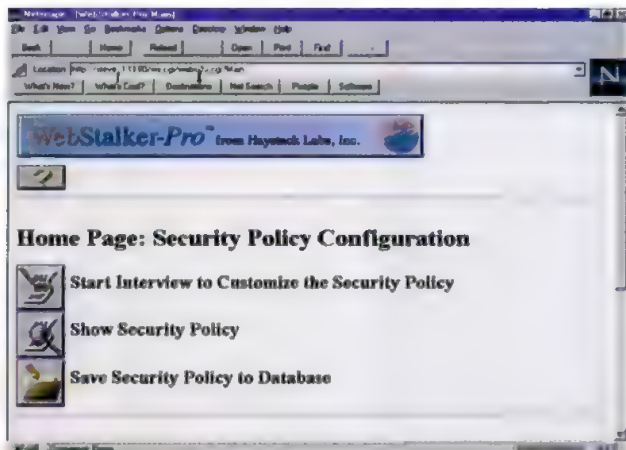
Stalk the Stalkers

By Steve Rigney

If you're looking for an Internet security supplement, you may want to take a peek at WebStalker Pro for Windows NT (\$2,995 list for a single server and unlimited users), from Haystack Labs. This product resides on your Web server and protects the data you've stored from both local users

cellent reporting capabilities. But its primary function is detection and response. It can't always prevent folks from accessing the data on your Web server, but it can alert you if they do. For added security, you'll probably want to use a firewall as well.

WebStalker Pro runs on Windows NT 3.51 and 4.0 as an



A SECURITY PRO: WebStalker Pro's HTML-based configuration utility helps you create your security policy.

and outside intruders. It does so by letting you set protection policies that will, for example, shut down your Web server if an intruder tries to access protected data.

WebStalker Pro also has ex-

NT service and works with Microsoft's Internet Information Server (IIS) and Netscape Web servers. It relies on Windows NT's audit trails and event logs to alert it when a user has attempted to access

CROSSTALK



Leon Erlanger

“ Frank, trying to describe the security market is like painting a moving train. The threat is shadowy and rumors seem worse than reality, but you can't take a chance. Generally, it seems that firewall vendors are taking the lead in delivering solutions. This is a case where IS managers must find a firewall vendor they trust and follow that company's lead. ”

“ Eventually, Leon, I see various security services merging with services like backup and becoming a value-added package provided by an ISP. Today's ISPs, along with telephone companies, cable companies, and many others, will become Enhanced Service Providers (ESPs), but the feature driving the business will be security. ”



Frank Derfler

protected data. The audit trails and event logs track everything, but they only show the series of events leading up to an intruder's entry. If your server goes down and no one is around to log back on, you'll be protected, since WebStalker Pro is an NT service.

Two of WebStalker Pro's strengths are its easy installation and friendly interface. The product uses interviews to walk you through setting up protection policies: illegal log-ons, jumpers, file access, Web server shutdowns, and WebStalker self-defense. Illegal log-ons prevent users with the wrong name or IP address from accessing the system. Illegal jumpers restrict users from accessing other PCs on the network from your Web server. Illegal file access policies protect your important data, and the Web-server shutdown feature will prevent an intruder from killing the Web server process. The WebStalker defense keeps users from changing your WebStalker Pro database to gain entry.

In the interview process, you can determine what policies you want to turn on, which users can access this information, and what response you want to be taken against an intruder. The responses are numerous and include terminating the user's log-on, killing

the process, sending e-mail to the administrator, logging the action to a file, or even paging the administrator. But the e-mail notification works only if you have an SMTP e-mail server, and you'll need a third-party product for the pager capabilities.

In spite of its strengths, we did find a couple of disadvantages to WebStalker Pro. During our tests, we detected an IIS feature that prevents WebStalker Pro from protecting against FTP file transfers. We configured WebStalker Pro to disable the log-on if a user tried to access a certain directory. We were able, however, to FTP files to and from that directory constantly without losing our connection. FTP apparently runs as a service on IIS, and WebStalker Pro can't disable the service. Even when we logged off the server, we could still reconnect, because IIS caches the user information, and the log-on restriction wasn't present in the cache. WebStalker Pro tracked our activity, yet the damage was done. But WebStalker Pro was able to protect other IIS services including HTTP and telnet access.

WebStalker Pro for Windows NT. List price: \$2,995. Haystack Labs Inc., Austin, TX; 512-918-3555; fax, 512-918-1265; www.haystack.com. Circle 953 on reader service card.

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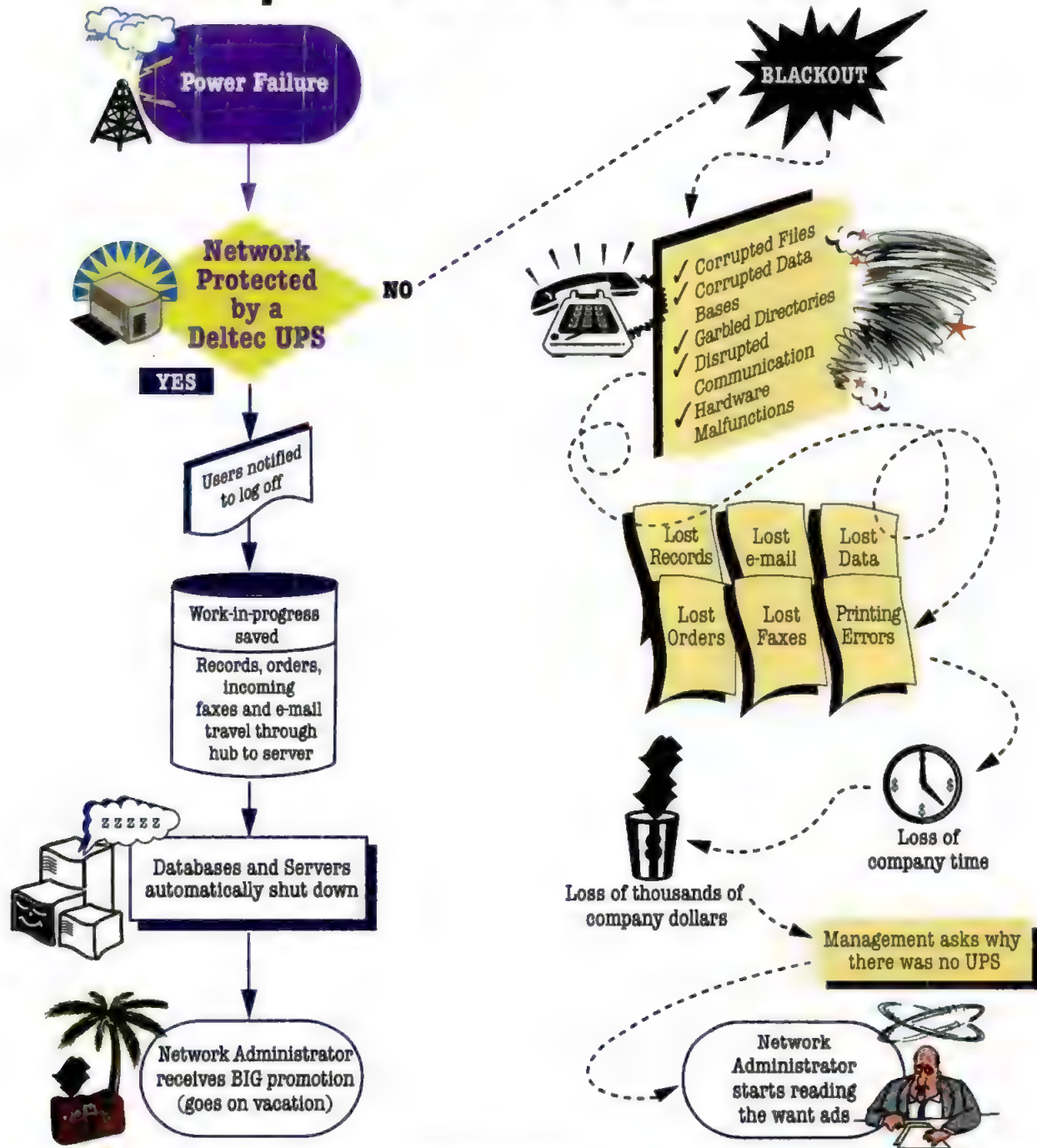
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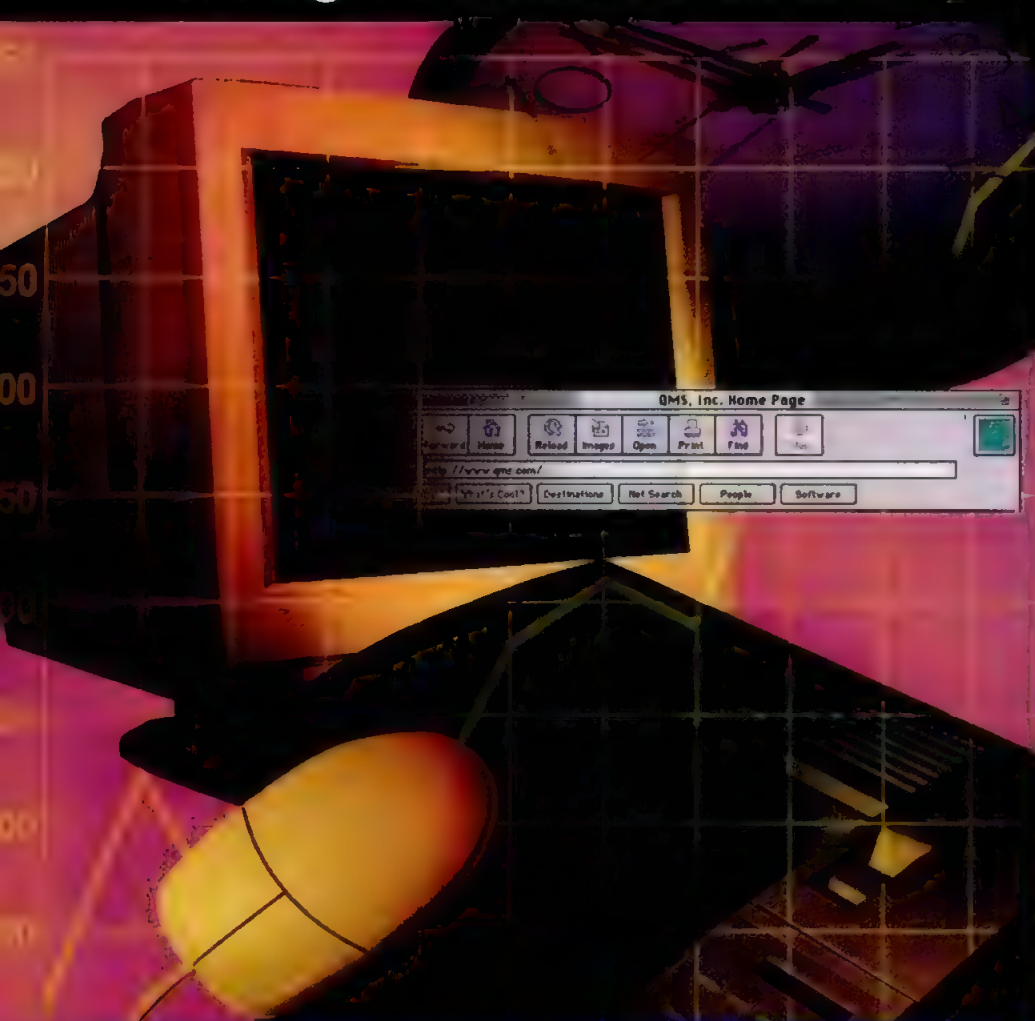
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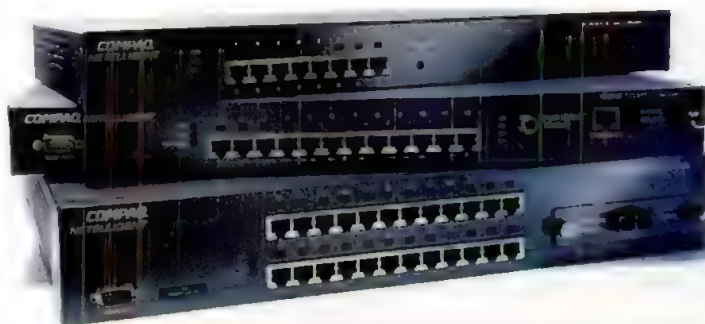


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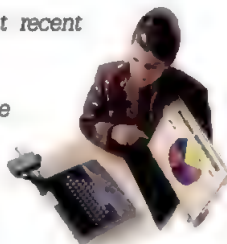
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FUTURE VERSIONS of the Pentium II processor may incorporate smaller amounts of L2 cache (possibly 256K) to reduce production costs.

THE PROCESSOR: 233-, 266-, or 300-MHz; 0.35-micron, 2.8V, four-metal-layer CMOS in plastic land-grid array package with metal heat spreader. 32K nonblocking L1 cache (16K instruction/16K data), run at processor frequency; 57 MMX instructions; eight 64-bit MMX registers. 7.5-million-transistor core, 203-mm² die. Mounted on small printed circuit board (PCB); glueless two-way SMP supported.

THE CONNECTOR: Once the substrate holding the CPU, 512K of L2 cache, and TagRAM is encased inside a SEC (single-edge contact) cartridge, the processor connects to the motherboard via Intel's new Slot 1.

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Pentium PART II

PC Labs tests 15 Pentium II PCs at 233 MHz and 266 MHz, in both single- and dual-CPU configurations.

By Cade Metz

Everybody loves a sequel. Hollywood knows it. The publishing industry knows it. And Intel knows it. The company has dubbed its latest microprocessor the *Pentium II*—a designation that leverages the PC industry's most recognizable brand name yet alludes to change and progress.

The chip, formerly known as Klamath, uses essentially the same core architecture as Intel's Pentium Pro processor. To this core, Intel has added MMX technology and a scheme that speeds performance under 16-bit operating systems. Of course, the Pentium Pro's talent for running 32-bit code remains intact.

The Pentium II, however, is packaged differently from the Pentium Pro. Rather than being coupled with a full-speed secondary cache in a ceramic package, it is mounted on a circuit board, or *substrate* (along with 512K of L2 cache), and encased in a palm-size single-edge contact (SEC) cartridge.

Manufactured in the same process as Intel's Pentium Processor with MMX Technology, the Pentium II is the fastest x86 processor on the market: 233- and 266-MHz clock speeds are already available, and a 300-MHz version will arrive soon. Under Windows NT, the chip has no peer. Under Windows 95, its only rival comes from outside Intel. With Microsoft's semi-16-bit operating system loaded, AMD's 233-MHz K6 processor matches the

THE L2 CACHE: 512K of four-way set-associative, nonblocking synchronous-burst SRAM cache. The cache runs at half core processor speed (or 133 MHz for a 266-MHz CPU).

The new Pentium II processor has taken its place at the pinnacle of Intel's CPU lineup. Running at speeds of 233, 266, and soon 300 MHz, the Pentium II uses the same core architecture as the Pentium Pro, but ups the ante with Intel's MMX instruction set and with renamable segment registers to speed 16-bit OS performance. Under Windows NT, the Pentium II has no equal. But under Windows 95, the chip is challenged by AMD's new K6 processor. Whether you're running 32-bit office applications or multithreaded apps that demand a dual-CPU machine, if you have a need for speed, the Pentium II delivers.

Pentium II clock for clock when running standard x86 code and betters the Pentium II when running MMX software. These are the industry's preeminent processors, and they will remain so through year's end.

IN THIS REVIEW

We review 15 Pentium II systems spanning many markets, from extravagant 266-MHz business-oriented PCs to affordable and adept 233-MHz desktops and dual-processor multimedia workstations. Each is equipped with a 2GB or larger hard disk,

x86 operation into simple micro-ops, which could then be handled with such RISC principles as multiple branch prediction, speculative execution, out-of-order execution, and register renaming.

Despite a subsequent upgrade to 200

nificant changes to the P6 architecture: It sped up segment register writes and added the MMX instruction set. Both revisions were reflected in our test results.

Equipped with renamable segment registers, the Pentium II executes writes spec-

ulatively and allows instructions that use the old segment value to coexist with instructions using the new value. Thus, during our Windows 95 testing, the 266-MHz Pentium II PCs garnered scores roughly 50 percent better than the Pentium Pro on our CPUmark₁₆ tests (which measure the raw speed of the CPU subsystem while running 16-bit code). The Pentium and MMX Pentium PCs bested the Pentium Pro

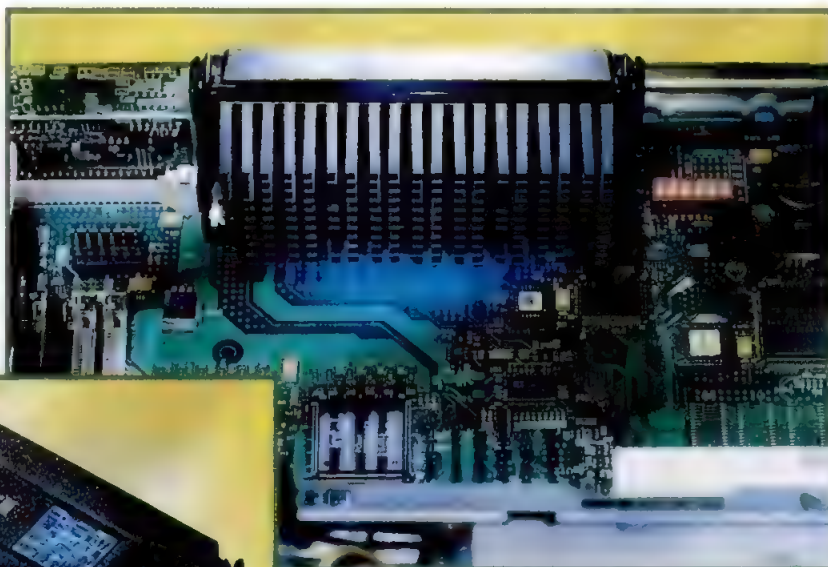
on the CPUmark₁₆ tests as well, but neither could rival the 266-MHz Pentium IIs.

Pentium II users can also benefit from accelerated multimedia with MMX software. Most MMX titles are unsuited for the corporate environment, but Intel expects MMX to play a significant role in videoconferencing, among other apps. Intel also claims that when drivers are ready—and they are coming soon—printing will also be improved by MMX technology. Running our MMX-enabled Adobe Photoshop scripts, the average 266-MHz Pentium II outperformed the Pentium Pro by a wide margin.

INSIDE THE CARTRIDGE

Like the MMX Pentium, the Pentium II uses Intel's 0.35μ CMOS manufacturing process. Forgoing the bulky, power-hungry bipolar hardware of BiCMOS processes, Intel has squeezed 7.5 million transistors into a 203-mm² die. Though only 6-mm² larger than the Pentium Pro, the Pentium II contains 2 million more transistors. Using a drawn gate size of only 0.28μ, Intel has also accelerated these transistors and achieved unprecedented x86 clock speeds.

The Pentium II's secondary cache, however, is actually slower than that of the Pentium Pro. Using a dual-cavity ceramic package, Intel equipped the Pen-



SEC CARTRIDGE: Metal case that houses PCB. Cartridge fits into Slot 1 interface that will be used with new Intel P6 CPUs. Thermal plate attached to cartridge; allows standard or custom heat sink.

a 6X or faster CD-ROM drive, 16-bit audio, 4MB of graphics RAM, and a 17-inch monitor.

Using our standard benchmark tests and a series of MMX-based scripts, we tested each system with 64MB of memory under Windows NT and contrasted the results with those of three control systems: a 200-MHz Pentium Pro with 256K of L2 cache, the Polywell Poly K6233 MX (the first K6 machine to market), and a custom-assembled K6 unit sent from AMD. We then pitted four representative Pentium II systems running Windows 95 with 32MB of RAM against the Pentium Pro and K6 machines just mentioned, a pair of classic Pentiums, and a pair of MMX Pentiums.

P6 ROOTS

The essence of the Pentium II has been on the market for almost two years. The P6 architecture—which debuted with the 150-MHz Pentium Pro in November 1995—was seminal in that it borrowed techniques from RISC CPUs to process Intel's traditional x86 instruction set. It converted each

MHz, the Pentium Pro never supplanted the Pentium in the mainstream PC market. Although its aptitude with 32-bit OSs such as Windows NT make it a player in the server and workstation markets, its high price and its infamous Achilles' heel keep the Pentium Pro off the typical desktop.

Its Achilles' heel was evident only under 16-bit operating systems: The Pentium Pro is extremely slow when writing to its segment registers. Segment register updates do not occur as frequently under 32-bit code but are quite common in legacy 16-bit software. In the Pentium Pro, a segment register update forces the pipeline to be flushed of instructions; all instructions using the existing segment value have to be processed before that value is overwritten. Add the time it takes to execute the actual write and there is a delay of almost 30 clock cycles. Consequently, the Pentium Pro does not perform as well as the Pentium under Windows 95.

ARCHITECTURAL ENHANCEMENTS

With the Pentium II, Intel made two sig-

tium Pro with an on-board L2 cache that ran clock for clock with the CPU. This arrangement is efficient but expensive to manufacture. To save production costs, the Pentium II uses an off-chip external cache that runs half as fast as the CPU itself. Though a Pentium II cache is still much faster than that of a Pentium, it trails the 200-MHz Pentium Pro cache.

To compensate, Intel has doubled the L1 cache on the Pentium II from 16K to 32K and thus reduced the frequency of calls to the L2 cache. With this alteration and a higher clock speed, the Pentium II (with 512K L2 cache) outperforms the Pentium Pro (with 256K L2 cache) by roughly 25 percent under Windows NT.

PACKAGING

Intel has not left the interplay of processor and secondary cache to the PC manufacturer. The vendor ships the Pentium II, its L2 cache, and its TagRAM in a plastic and metal SEC cartridge. Initially, Pentium II cartridges will ship with 512K of L2 cache, but Intel plans to offer various cache sizes and speeds for various market segments.

While the Pentium Pro uses a 387-pin grid array (PGA) ceramic package, the Pentium II die is housed by a 528-pin plastic land-grid array (PLGA) package. Using slim pads rather than pins, a PLGA package is significantly smaller than its PGA predecessor, has a lower profile, and is significantly cheaper to produce. This package is mounted on a substrate along with the L2 cache and TagRAM. One side of the substrate (the side that houses the processor core) is then covered by an aluminum cooling plate, while the other is encased in black plastic. This entire assembly—the so-called SEC cartridge—is adorned with the Pentium II logo and a multicolored hologram of the Pentium II die.

While the Pentium plugs into Socket 7 and the Pentium Pro plugs into Socket 8, the SEC cartridge slips into Slot 1 (about

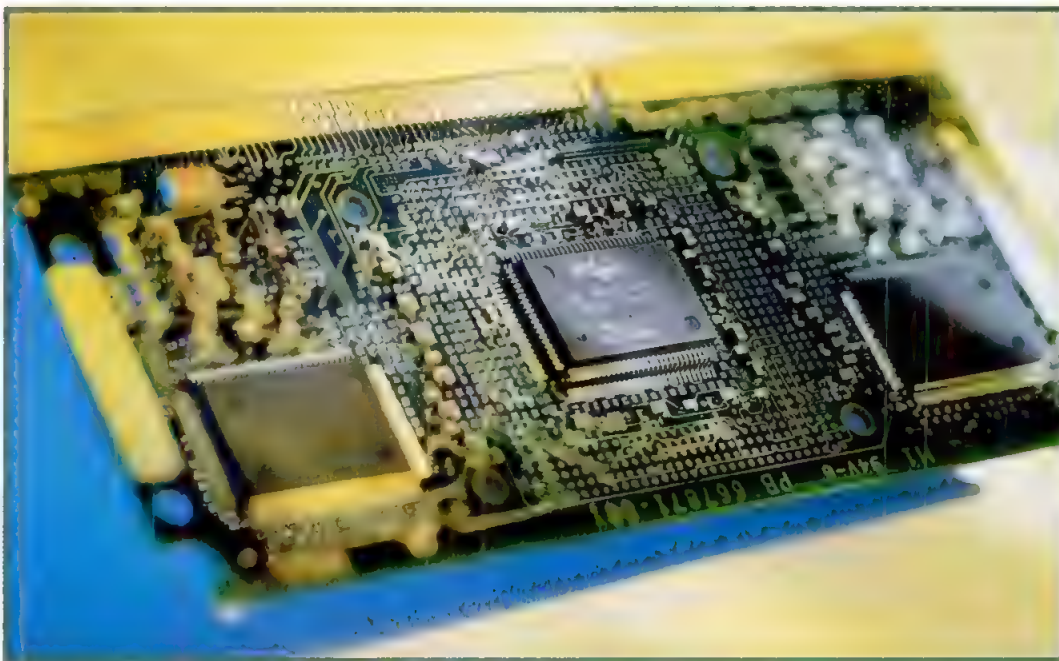
the size of an ISA slot). Any Slot 1 motherboard has a retention mechanism that consists of two vertical plastic supports. An SEC cartridge slides down between the supports and into Slot 1. Once the cartridge is in place, a heat sink is attached to the aluminum cooling plate (the sink can also be attached after the cartridge is in place). The 266-MHz Pentium II runs only slightly hotter than the 200-MHz Pentium Pro (38.2 watts versus 37.9 watts), but its heat sink is almost twice as large as those used in Socket 7 or Socket 8 processors, because of the size of the SEC cartridge.

According to Intel, the SEC cartridge reduces costs and addresses engineering concerns, such as electrical signaling issues, associated with high-speed processors. The additional pins needed for an external cache interface, the company says, would have made the chip too expensive to produce en masse in a PGA package. Of course, the cartridge gives Intel more

ware, the K6 lags well behind both speeds of the Pentium II, though it rivals a 200-MHz Pentium Pro. During Windows 95 testing, it matched the performance of the standard x86 233-MHz Pentium II and bettered the MMX performance of the 266-MHz Pentium II.

Although the Pentium II can process two MMX instructions simultaneously, the K6 must handle them one at a time. Yet many K6 MMX algorithms are more efficient than their Pentium II counterparts. While the Pentium II has a latency of three clock cycles for both multiply and multiply-add operations, K6 latencies for these operations are one and two cycles, respectively, making faster times for the K6 when running MMX code under Windows 95.

The K6 is also a bargain. While a 266-MHz Pentium II with 512K of L2 cache sells to PC vendors for \$775 (in quantities of 1,000) and the 233-MHz flavor (also



command of the PC space than ever before. Initially, Intel will purchase L2 cache SRAMs from outside sources, but that could change in the months to come.

COMPETITION FROM AMD

The Pentium II is also the first Intel processor to face immediate competition from an outside source. On April 2, AMD introduced the K6—a 233-MHz chip with a RISC-like core and MMX technology. Running Windows NT and full 32-bit soft-

THE TAG RAM (center chip, above): Intel proprietary design. Supplies tag entries for up to 512K of L2 cache. Larger L2 caches will require larger tag RAMs.

with 512K of L2) sells for \$636, a 233-MHz K6—sans secondary cache—is priced at \$469. Add the price of 512K of L2 cache, which is less than \$100, and the K6 is still cheaper than the Pentium II of similar speed. This is less expensive than both 200-MHz versions of the Pentium Pro

Editors' Choice

- Business PC: Dell Dimension XPS H266
- Home/personal PC: Gateway G6-266



Pentium II PCs are at home running either Windows 95 or Windows NT, and they are the fastest Intel PCs you can buy today.

If you're looking to outfit your small or medium-size business with an incredibly powerful, cutting-edge PC, the Dell Dimension XPS H266 (\$3,979) is a great choice. Outfitted with a new Matrox Millennium II graphics accelerator with 8MB of WRAM, this machine shattered all previously held Graphics WinMark records. The Dimension also produced top Winstone scores, leveraging the power of its graphics engine and 6.1GB IBM Fast ATA-3 hard disk. Dell also includes an Iomega Zip drive, an NEC 12X/16X CD-ROM drive, Microsoft Office 97 Small Business Edition, and a 33.6-Kbps voice modem.

(\$1,035 for the 512K L2 cache part and \$525 for the 256K L2 cache chip) and the 200-MHz MMX Pentium (about \$500). Out of the gate, the Pentium II is expensive (the 300-MHz version will sell for an astounding \$1,981), but its production costs are less than those of the Pentium Pro, and its pricing will soon reflect this.

THE FUTURE IS SLOT 1

Pricing aside, the only reason to postpone a leap to Pentium II and Slot 1 is to wait for Intel's new P6 chip set. By the end of the year, Intel will likely replace the aging 440FX with a new chip set. This new set, rumored to be the 440LX (although Intel has not yet confirmed the name), will provide support for AGP (Advanced Graphics Port, which gives graphics chips dedicated access to main memory), ECC RAM, and Ultra DMA hard disks.

If cost is a concern and Windows 95 is your OS of choice, the K6 is an attractive business hardware selection. AMD, in fact, plans to ship an AGP chip set by this fall. Otherwise, the Pentium II is the heir apparent to the Pentium in the corporate office. The market is moving toward the sequel and the sequels to the sequel. *Return of Pentium* or *Bride of Pentium* may soon be coming to a desktop near you.

Home or personal users on the leading edge of technology will find a great bargain in the \$3,349 Gateway G6-266, part of the vendor's multimedia series of PCs. This system may be the lowest-priced 266-MHz PC in this roundup, but it doesn't skimp on components. Gateway fills the G6-266's mid-tower case with a 6GB hard disk, an STB Nitro 3D GX graphics board, a Toshiba 12X/16X CD-ROM drive, a 56.6-Kbps voice modem, and a Zip drive. The software completing this package includes Microsoft Office 97 Small Business Edition as well as a bundle of MMX-enabled home and entertainment applications.

Acer America Corp.

AcerPower 9678NM+ Graphics Workstation

The AcerPower 9678NM+ Graphics Workstation (\$4,730 street) belies its moniker. Though this 266-MHz system is marketed toward multimedia professionals, its SCSI hard disk is much more adept than its graphics subsystem.

The top of this mini-tower has illustrated instructions for removing the chassis cover, which reveals a somewhat crowded interior. The SEC cartridge sits in the middle of the Acer motherboard, along with a heat sink and one CPU fan. The six SIMM slots next to the cartridge allow up to 384MB of EDO DRAM, but access to the slots is partially blocked by the power supply. A 4.2GB Seagate Cheetah Ultra Wide SCSI hard disk—plugged into an Adaptec PCI-to-SCSI controller—sits not in a typical drive bay but in a vertical tray at the base of the unit.

The 10,000-rpm Cheetah contributed to disk scores more than 30 percent higher than average. Using an STB Nitro 3D graphics card, the system's Business Graphics WinMark 97 score, however, was almost 15 percent below average; its High-End Graphics WinMark 97 score was average. Its Business Winstone 97 score was also below average.

This unit also ships with Microsoft Windows NT 4.0 (Windows 95 is optional), Lotus SmartSuite, Intel's LANDesk Client Manager, and McAfee VirusScan. The DMI-compliant AcerPower is certainly appropriate for business use, although its performance was mixed.—Cade Metz

AcerPower 9678NM+ Graphics Workstation. Street price: \$4,730. Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; fax, 408-922-2933; www.acer.com/aac. Circle 500 on reader service card.

AST Computer

AST Bravo LC 6233

With an aggressive street price of \$3,450, AST Computer's AST Bravo LC 6233 is the least expensive PC here. This 233-MHz Pentium II desktop comes with ample software, but its performance on our benchmark tests lagged.

The unit is at the top of AST's Bravo LC line of value-priced business desktops. The lockable chassis is highly compartmentalized, making it easy to get to all internal components. The unit's expansion slots are on a riser, and the



Acer Power 9678NM+ Graphics Workstation, AST Bravo LC 6233.

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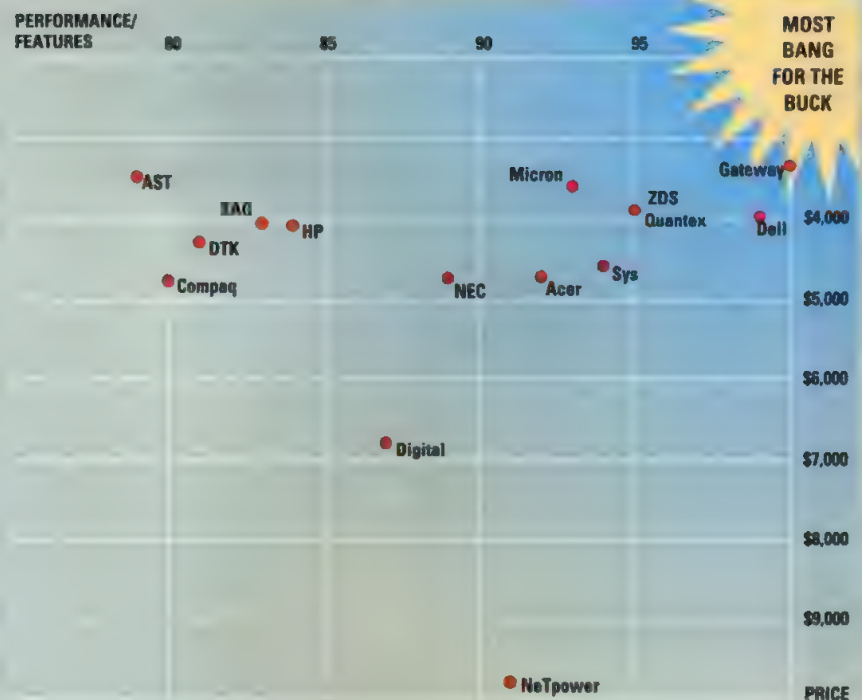
Price/Performance Index: Pentium II PCs

We tailor our price/performance chart for every roundup. Since this is a review of the new high-speed Pentium II PCs, we focused on performance.

THE DATA POINTS

All of the features counted, plus benchmark test scores, are given various weightings to create the performance/features score for each system. The ZD Business Winstone 97 tests represent overall system performance in a general 32-bit business environment, and the ZD High-End Winstone 97 tests represent overall system performance under more demanding graphical and processing-intensive 32-bit environments; they were given a combined weight of nearly 38 percent. Performance on two of our Photoshop tests, the Unsharpen Mask test and Gaussian Blur test, was given a total weight of 5.5 percent; CD-ROM performance accounts for 5.5 percent.

The monitor's viewable diagonal size and the size of the hard disk account for about 10 percent. The warranty on parts and labor, on-site



service, and technical-support options account for 12.5 percent.

Network cards, modem speeds, and USB ports account for nearly 10 percent of the score. Available expansion

and tool-free chassis make up about 5 percent. The remaining portion of the score is based on the presence of serial and mouse ports as well as the presence of a flash BIOS, among other features.

motherboard has two USB ports.

The unit came with a 2GB IBM hard disk, the smallest in this roundup, as well as a Torisan 8X/16X CD-ROM drive. Its motherboard is designed with integrated S3 3D ViRGE graphics circuitry, but our test unit included a Matrox Millennium PCI graphics board with 8MB of WRAM.

On most of our benchmark tests, the Bravo LC fell well behind the SAG STA Pen II, its lone competitor in the 233-MHz Pentium II class. The unit managed to keep pace with the pack on our Business Graphics WinMark 97 and CD-ROM WinMark 97 tests, but it fell behind the 266-MHz Pentium II units reviewed here.

The system comes with online help and a number of useful utilities, including Quarterdeck's CleanSweep 3.0, McAfee VirusScan, Intel LANDesk (client-management software), and SoftQuad's HoT-MetaL Light (a Web-page editor).

If a low price is more important than

top performance, the Bravo is worth a second look.—Robert S. Anthony

AST Bravo LC 6233. Street price: \$3,450. AST Computer, Irvine, CA; 800-876-4278, 714-727-4141; faxback, 800-926-1278; www.ast.com. Circle 501 on reader service card.

Compaq Computer Corp.

Deskpro 6000 M6266/4200/CDS

The Deskpro 6000 M6266/4200/CDS (\$4,780 street) is one of the more expensive 266-MHz machines here. But as Compaq's top business-oriented Pentium II, it offers some of the best maintenance and management features available.

Our Contributors: CADE METZ is a staff writer for *PC Magazine*. NICK STAM is technical director of hardware at PC Labs. ROBERT S. ANTHONY is a senior writer, and MARY E. BEHR and ANUSH YEGYAZARIAN are staff editors of *PC Magazine*. CAROL VENEZIA was the senior editor in charge of this story, and S. JAE YANG was the project leader.

The slimline system offers little room for expansion (only one front-accessible 5.25-inch drive bay, one PCI slot, and one shared slot are available). Expansion slots reside on a riser card inside a metal cage; you must remove the cage and the riser card to add new hardware.

Uniquely, the Deskpro 6000's SEC cartridge does not stand perpendicular to the motherboard; it lies down flat beneath a slim, gold heat sink. The motherboard also integrates a 10-Mbps NetFlex-3 Ethernet controller that works in tandem with Compaq's Enhanced Intelligent Manageability features (which include a cover-removal sensor, thermal monitoring, and imminent-drive-failure detection,

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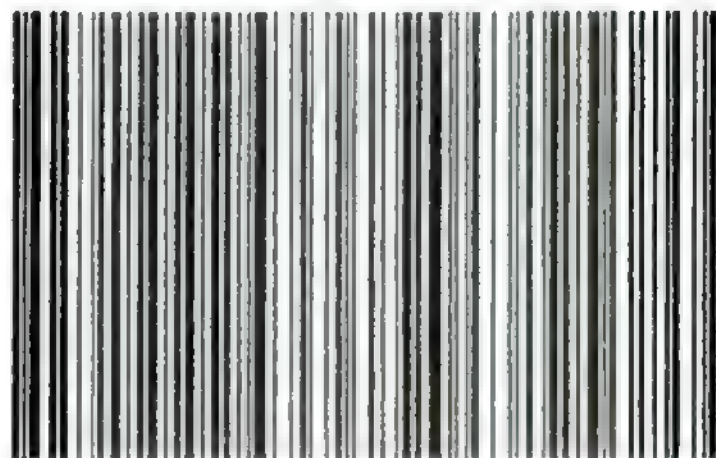
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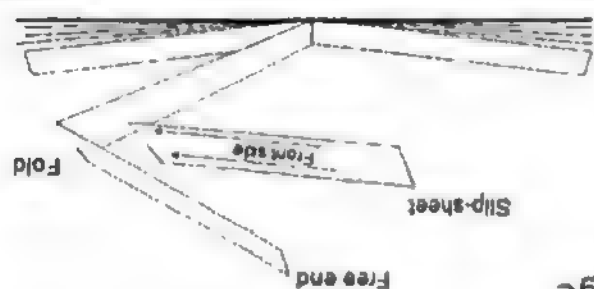
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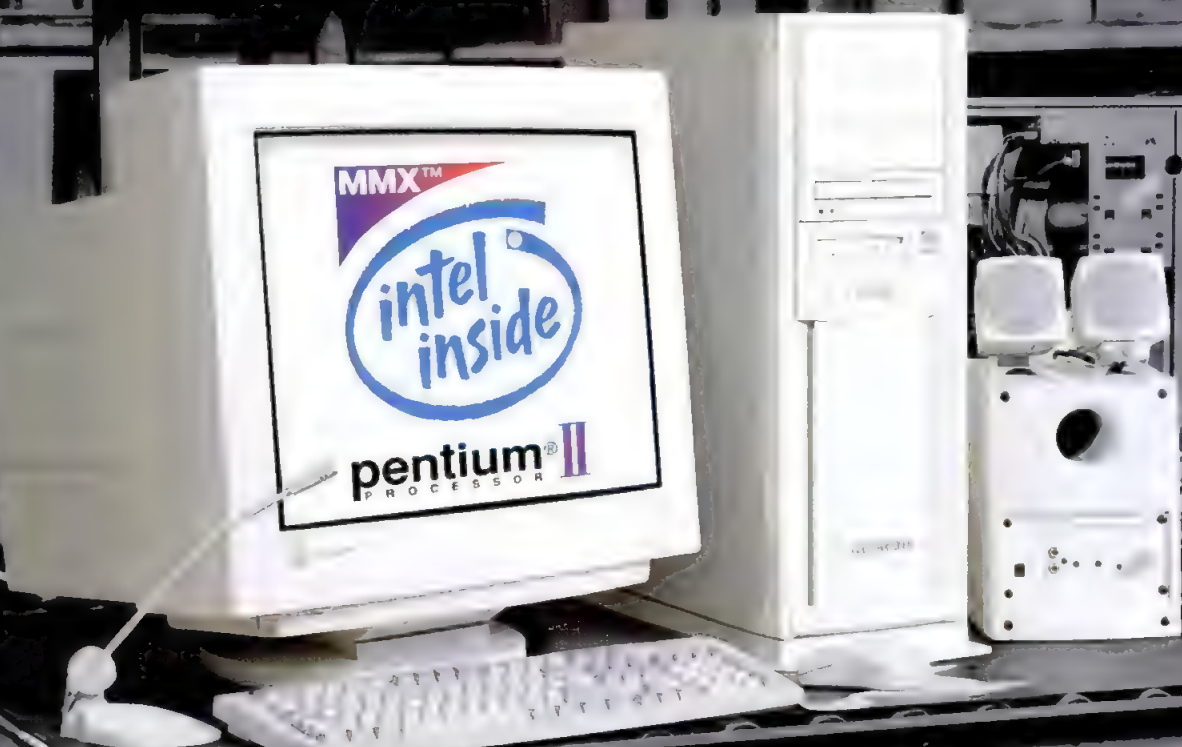
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[This G6-266XL is loaded to the max, including a huge monitor with a 15.1-inch viewable area and the Boston Acoustics High-Fidelity 3-Piece Speaker System.]

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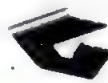
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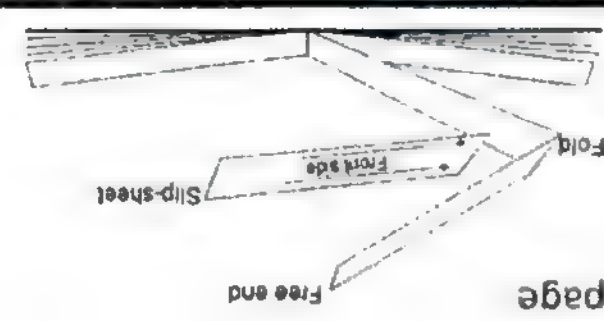
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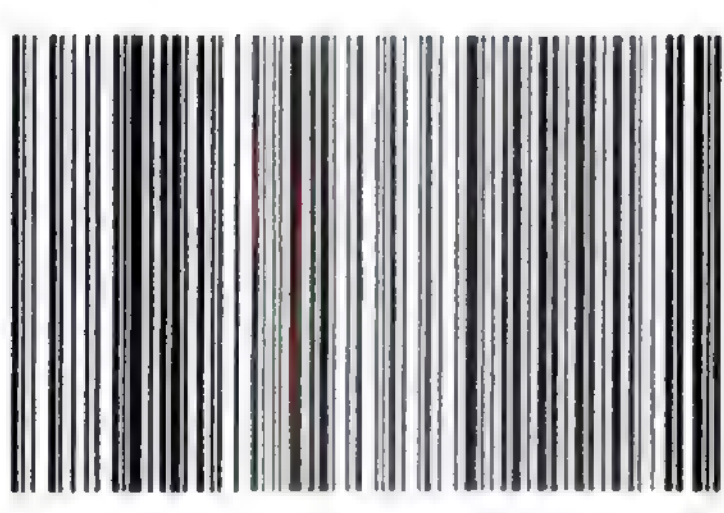
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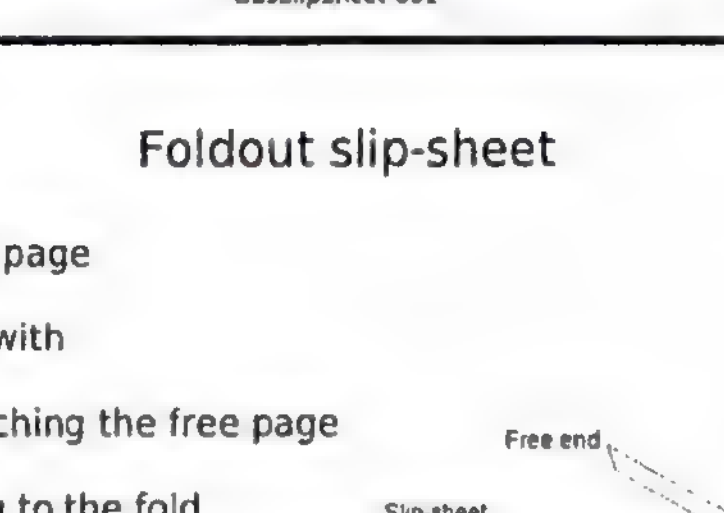
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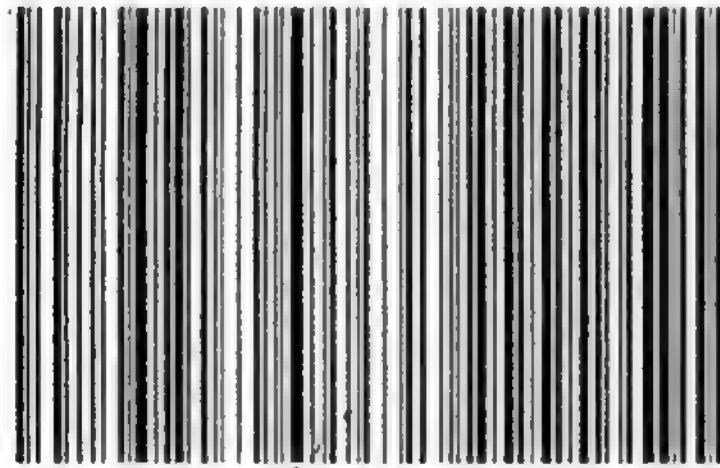
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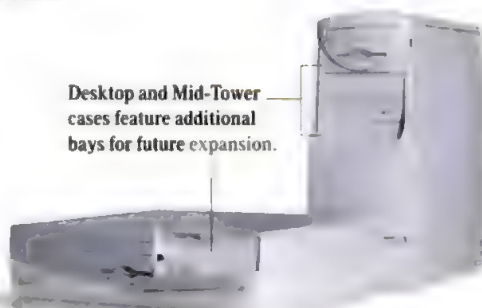
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G5-166

- Intel 166MHz Pentium Processor
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- 256K Pipelined Burst Cache
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- 2MB 3-D 64-Bit PCI Graphics
- 1.6GB 12ms EIDE Hard Drive
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BENCHMARK TESTS

Pentium II PCs



Intel talked the talk, and the Pentium II walked the walk. We executed a comprehensive test suite to size up the latest Intel CPU against its predecessors and AMD's new K6. When the dust cleared, the Pentium II emerged as the new champion of x86 processors.

What the Numbers Mean

To put this batch of 15 Pentium II PCs in perspective, we gauged their performance against sample systems running various x86 processors. Here we report the results of the Pentium II systems side by side with those of a 200-MHz Pentium Pro PC, a 233-MHz K6 reference machine supplied by AMD, and a new 233-MHz K6 PC from Polywell, each running Windows NT 4.0. For an even broader comparison, we loaded two 266-MHz Pentium II systems and one 233-MHz Pentium II system with 32MB of RAM and Windows 95 and pitted them against the Pentium Pro, the two K6 machines, two 200-MHz MMX Pentium systems, and two 200-MHz classic Pentiums. All of the aforementioned units are shipping products except the engineering reference model

that AMD provided. The data from this system cannot be used for a linear comparison, in view of its oversize 1MB of L2 cache and 32MB Ultra Wide SCSI caching disk controller, neither of which is often found in mainstream PC configurations. The Polywell, the first K6 machine to market, provides a more accurate comparison.

ZD High-End Winstone 97 and ZD Business Winstone 97

High-End Winstone 97 executes a script that runs a set of applications that heavily exercise the CPU and graphics subsystems, and Business Winstone 97 profiles the performance with more mainstream applications. In both categories, the systems powered by 266-MHz Pentium II CPUs dominated. Under Windows NT 4.0, the Dell Dimension XPS H266 and the Quantex QPC/266 SM-4X, on the strength of their Matrox Millennium II graphics cards, tied for first place on our High-End Winstone tests. In the Business Winstone category, Sys Technology's Sys Performance Pro 266 claimed top honors, thanks to its powerful 10,000-rpm Seagate Cheetah hard disk.

The dual-CPU Pentium II systems we tested (the Digital Celebris GL-2 6233 ST and the NeTpower Symetra2 Workstation) performed no better than the single-processor machines, because none of the applications in Winstone are multithreaded; coordinating multiple processors requires more OS intervention. By wide margins, the Polywell K6 had the lowest High-End and Business Winstone scores under Windows NT.

To compare the Pentium II with more mainstream processors, we leveled the playing field using Windows 95 and 32MB of RAM and ran Business Winstone 97. As expected, the three systems representing the Pentium II posted scores that were, on the aver-

WINDOWS NT 4.0

▼ Lower scores represent better performance.
Bold type denotes first place.

	ZD High-End Winstone 97 Score	ZD High-End Graphics WinMark 97 Score	ZD High-End Disk WinMark 97 Thousands of bytes per second	ZD Business Winstone 97 Score
AcerPower 9678NM+ Graphics Workstation (P II/266)	35	41	4,640	72
AST Bravo LC 8233 (P II/233)	30	30	2,560	67
Compaq Deskpro 6000 M6266/4200/CDS (P II/266)	33	45	3,270	73
Dell Dimension XPS H266 (P II/266)	36	50	3,560	76
Digital Celebris GL-2 6233 ST (dual P II/233)	30	27	2,960	67
DTK Apri-74M/K266 (P II/266)	35	41	4,560	74
Gateway G6-266 (P II/266)	34	41	3,070	71
HP Vectra VL II/266 (P II/266)	34	47	2,460	70
Micron ClientPro XLU (P II/266)	33	41	3,150	76
NEC PowerMate Professional (P II/266)	34	40	3,270	75
NeTpower Symetra2 Workstation (dual P II/266)	32	31	3,240	70
Quantex QPC/266 SM-4X (P II/266)	36	48	3,270	73
SAB STA Pen II (P II/233)	33	36	4,000	72
Sys Performance Pro 266 (P II/266)	36	47	4,890	77
ZDS Performance 266 (P II/266)	34	40	3,100	73
Polywell Poly K6233 MX (K6/233)*	24	18	2,730	47
AMD reference PC (K6/233)*	28	31	3,740	72
Pentium Pro/200*	25	28	1,700	60

* Reported for comparison.

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age, 24 percent better than the MMX Pentium systems, and 40 percent better than the classic Pentiums. The K6, however, performed remarkably well under Windows 95. On Business Winstone 97, the Polywell trailed the two 266-MHz Pentium IIs only slightly and matched the 233-MHz Pentium II.

ZD High-End and Business Graphics WinMark 97 Although the new Intel CPU is the story, we couldn't ignore the subplot forming among the graphics subsystems. With its MGA-2164W 64-bit chip set, the new Matrox Millennium II stood out, powering the Dell Dimension XPS H266 and the Quantex QP6/266 SM-4X to the top of both High-End Graphics and Business Graphics WinMark 97 tests. The Millennium II's immediate predecessor, the Millennium, was found among the best of the rest.

ZD High-End and Business Disk WinMark 97 Seagate's 10,000-rpm Cheetah Ultra Wide SCSI hard disk was in a league of its own on our tests. Four systems that use this disk—the AcerPower 9678NM+ Graphics Workstation, the DTK Apri-74M/K266, the SAG STA Pen II, and the Sys Performance Pro 266—turned in top scores on both High-End and Business Disk WinMark 97 tests.

ZD CPUmark₁₆ and CPUmark₃₂ Both the ZD CPUmark₁₆ and the ZD CPUmark₃₂ results fell in line with what we expected. Under Windows NT, the 266-MHz Pentium II systems, on the average, garnered CPUmark₃₂ scores that were 16 percent better than the 233-MHz Pentium II machines, which in turn outperformed the 233-MHz K6 systems by 11 percent.

Running CPUmarkII₁₆, however, the 233-MHz K6 rivaled the 233-MHz Pentium under both Windows NT and Windows 95.

Adobe Photoshop Using three different filters in Adobe Photoshop 4.0, we learned the effects of MMX technology and dual processors. Because Photoshop is multithreaded, the dual-processor Digital and NeTpower machines outperformed all other systems under Windows NT. The average Pentium II system was significantly faster than the Pentium Pro, which lacks MMX Technology. The surprise of our Photoshop testing was the K6, which AMD has equipped with its own MMX implementation. Though the K6 was slower than the Pentium II under Windows NT, its Photoshop scores bettered those of both the 266- and 233-MHz Pentium IIs under Windows 95.

ZD Winstone 96

We brought our 1996 benchmark test program out of storage to verify Intel's claim that the Pentium II handles 16-bit code significantly better than its predecessor, the Pentium Pro. In line with our expectations, the Pentium II systems yielded Winstone 96 scores that were 42 percent better than the Pentium Pro.—

Analysis written by S. Jae Yang

How We Tested

We tested all Pentium II systems with Windows NT 4.0, 2GB hard disks or larger, 6X CD-ROM drives or faster, and 64MB of RAM. We used each vendor's preinstalled graphics driver for 1,024-by-768 resolution with 24-bit color for our high-end benchmark tests and 16-bit color for our business benchmark tests. We

ZD Business Graphics WinMark 97		ZD Business Disk WinMark 97		ZD CPUmark ₁₆		ZD CPUmark ₃₂		Adobe Photoshop		
Score		Thousands of bytes per second		Score		Score		Facet (seconds) ▼	Gaussian Blur (seconds) ▼	Unsharpen Mask (seconds) ▼
92		1,450		522		695		9.3	8.0	2.3
100		862		457		809		10.7	7.1	2.8
111		1,010		530		716		10.5	7.0	2.9
125		1,040		535		719		9.2	5.8	2.4
92		927		456		808		5.8	3.7	1.7
95		1,410		534		727		9.3	5.8	2.3
93		949		530		717		9.4	5.9	2.5
113		814		523		696		9.1	5.7	2.1
106		1,100		535		728		9.0	5.8	2.1
110		1,010		536		730		8.8	5.8	2.3
104		1,040		533		723		9.0	3.8	1.4
123		980		522		695		9.4	5.9	2.4
100		1,320		463		628		10.2	6.5	2.7
117		1,320		521		697		8.8	5.8	2.2
109		975		532		719		9.3	5.9	2.4
74		982		453		557		10.7	12.1	4.2
94		1,580		456		550		10.1	11.3	4.1
88		720		359		585		23.4	10.6	11.8
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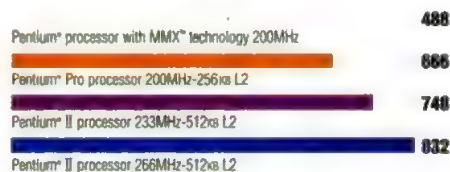
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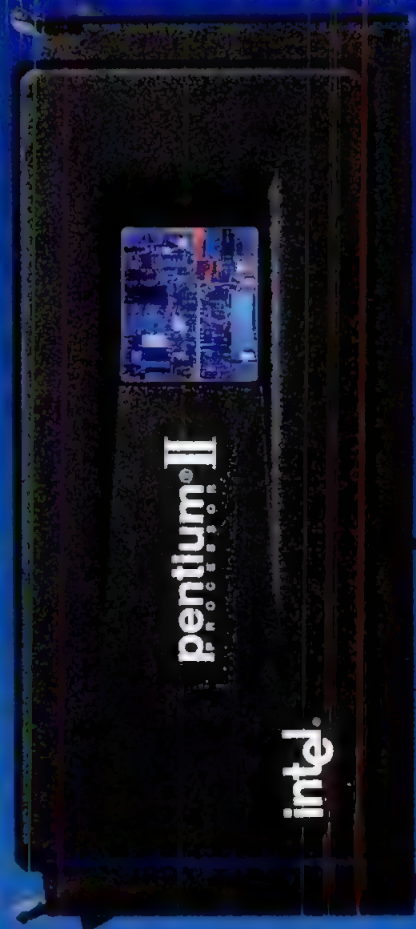
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BENCHMARK TESTS

used small fonts and set the refresh rate as close to 75 Hz as possible. For comparison, we tested sample K6 and Pentium Pro systems using the same configuration. We also downgraded select Pentium II systems to 32MB RAM and switched the OS to Windows 95 to compare performance results with a broader range of systems based on Pentium MMX, classic Pentium, Pentium Pro, and K6 processors. We ran the business benchmark tests under Windows 95, along with Winstone 96 and WinBench 96 (CPUmark¹⁶ only) to gauge 16-bit performance. For all tests, we disabled power management features and removed unnecessary drivers. We defragmented hard disks before each test and let Windows 95 or Windows NT 4.0 manage virtual-memory settings.

We used our benchmark test program **ZD Winstone 97, Version 1.0**, to measure the machines' performance when running 32-bit Windows applications. Winstone 97 is divided into two categories: **ZD Business Winstone 97**, which focuses on mainstream applications, and **ZD High-End Winstone 97**, which emphasizes CPU- and graphics-intensive applications. We ran our Business Winstone tests under Windows 95, along with Winstone 96 and WinBench 96 (CPUmark¹⁶ only) to gauge 16-bit performance. For all tests, we disabled power management features and removed unnecessary drivers. We defragmented hard disks before each test and let Windows 95 or Windows NT 4.0 manage virtual-memory settings.

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ZD WinBench 97, Version 1.1, measures graphics, disk, processor, CD-ROM, and motion-video performance under Windows. Version 1.1 incorporates updates to Disk WinMark 97 and the video tests. Disk WinMark 97 was updated to address Microsoft's changes to the buffer flush routines in OSR2. The video tests now utilize the new ActiveMovie media control architecture, which

Microsoft populated through OSR2 and Internet Explorer 3.0. Like our Winstone test suite, **ZD Graphics WinMark 97** and **ZD Disk WinMark 97** are each divided into Business and High-End sections. We ran both the Business Graphics and Business Disk WinMark tests under Windows 95 and Windows NT 4.0; the High-End tests were run only under Windows NT 4.0.

The **ZD Business Graphics WinMark 97** score, a number based on a log of GDI operations used in the Business Winstone suite, represents the performance of each machine's graphics subsystem under Windows 95. The **ZD High-End Graphics WinMark 97** score is based on a log of GDI operations in High-End Winstone 97 and reflects the performance of each machine's graphics subsystem under Windows NT 4.0.

The **ZD Business Disk WinMark 97** score, based on a log of disk functions used in the Business Winstone suite, represents the performance of each machine's disk subsystem under Windows 95. The **ZD High-End Disk WinMark 97** score, based on a log of disk functions under High-End Winstone 97, reflects a machine's disk subsystem performance under Windows NT 4.0.

The **CPUmark¹⁶** and **CPUmark³²** scores gauge the speed of a PC's processor subsystem—which includes the CPU, secondary cache, and system RAM—under 16- and 32-bit operating systems, respectively. Both CPUmark tests emulate the CPU activity of real-world applications. CPU tests were run under Windows 95 and Windows NT 4.0.

The **ZD CD-ROM WinMark 97** tests gauge the performance of each machine's CD-ROM subsystem, which includes the CD-ROM drive, its adapter, and its required software drivers. The tests are based on a profile of six of today's most popular Windows CD-ROMs. We report the results of the CD-ROM **Sequential 16K Read** tests, which measure the throughput of a CD-ROM subsystem as it reads 16K blocks of data on a CD-ROM. The CD-ROM **Access Time** score measures CD-ROM drive performance as it randomly accesses 2K blocks from the entire CD-ROM. The CD-ROM **CPU Utilization** score represents the percentage of the CPU's bandwidth occupied in servicing the CD-ROM subsystem as it retrieves data.

WinBench 97 also includes a suite of video tests that measure a PC's ability to play full-motion .AVI files. We test video-playback performance with two types of clips at a variety of data and frame rates, using either an Indeo or a Cinepak codec. We report results from the **Full-Screen Scaling** test, which uses the Action

WINDOWS 95

▼ Lower scores represent better performance.
Bold type denotes first place.

	ZD Business Winstone 97 Score	ZD Business Graphics WinMark 97 Score	ZD Business Disk WinMark 97 Thousands of bytes per second
AST Bravo LC 6233 (P II/233)	51	104	997
Dell Dimension XPS H266 (P II/266)	54	112	1,190
Micron ClientPro XLU (P II/266)	54	109	1,120
Polywell Poly K8233 MX (K6/233)*	49	80	1,310
AMD reference PC (K6/233)*	52	72	2,310
Pentium Pro/200*	43	57	785
Pentium MMX/200 A*	43	72	947
Pentium MMX/200 B*	45	73	1,210
Pentium/200 A*	38	57	887
Pentium/200 B*	40	57	1,160

* Reported for comparison.

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WINDOWS NT 4.0

	ZD CD-ROM WinMark 97 Thousands of bytes per second ▲	CD-ROM Sequential 16K Read (thousands of bytes per second) ▲	Access Time (ms) ▼	CPU Utilization (percent) ▼	Full-Screen Scaling ¹ Frames dropped ▼	High-Quality Action Cinepak ² Frames dropped ▼
▲ Higher scores represent better performance. ▼ Lower scores represent better performance.						
AcerPower 9678NM+ Graphics Workstation (P II/266)	1,340	1,490	119.0	45	13	2
AST Bravo LC 6233 (P II/233)	1,150	1,300	110.0	42	1	0
Compaq Deskpro 6000 M6266/4200/CDS (P II/266)	715	1,210	164.0	94	32	418
Dell Dimension XPS H266 (P II/266)	1,270	1,800	114.0	5	1	1
Digital Celebris GL-2 6233 ST (dual P II/233)	1,210	1,870	139.0	4	1	1
DTK Apri-74M/K266 (P II/266)	1,470	1,490	104.0	5	77	1
Gateway G6-266 (P II/266)	1,360	1,650	125.0	53	4	0
HP Vectra VL 6/266 (P II/266)	1,300	1,360	94.6	3	1	1
Micron ClientPro XLU (P II/266)	1,300	1,360	92.7	4	73	1
NEC PowerMate Professional (P II/266)	1,330	1,460	110.0	44	5	65
Netpower Symetra2 Workstation (dual P II/266)	1,350	1,670	121.0	39	3	1
Quantex QP6/266 SM-4X (P II/266)	1,290	1,690	114.0	5	1	1
SAG STA Pen II (P II/233)	1,300	1,520	119.0	47	4	0
Sys Performance Pro 266 (P II/266)	1,150	1,790	174.0	77	7	1
ZDS Performance 266 (P II/266)	1,360	1,660	120.0	4	1	1

(1) With an Action, Indeo, 160-by-120, 30-fps, 300-Kbps clip.
(2) With an Action, Cinepak, 640-by-480, 30-fps, 900-Kbps clip.

Indeo, 160-by-120, 30-frame-per-second, 300-Kbps clip, and the **High-Quality Action Cinepak** test, which uses a Cinepak, 640-by-480, 30-fps, 900-Kbps video clip. For both sets of tests, we report **Frames Dropped**.

We also used our **Winstone 96, Version 1.0**, benchmark test suite to measure the machines' performance when running typical 16-bit Windows applications under Windows 95. Winstone 96 measures the time a PC takes to execute a set of application scripts that exercise 13 16-bit Windows applications. Winstone weights a given PC's test timings based on the applications' unit market shares; it derives a composite number and converts it to a relative score. (The score is relative to the performance of a 486SX/25 Dell 425s/P with 8MB of RAM, whose score is defined as 10.)

Application Tests

We tested these PCs with **Adobe PhotoShop, Version 4.0**, at 24-bit color and 1,024-by-768 resolution. We present results for three Photoshop filters that use MMX and multithreaded instructions: **Facet**, **Gaussian Blur**, and **Unsharpen Mask**. The **Facet** test sharply defines a selection by clumping pixels of similar color values in cells. The **Gaussian Blur** test blurs an image by an adjustable amount, adding low-frequency detail, and it can produce hazy or completely blurred effects; we applied a blur radius of 10. The **Unsharpen Mask** test accentuates object edges by varying contrast between pixels. For this test we left the amount setting at 50 percent, the radius at 1.0 pixels, and the threshold at 0 level—the default settings. We applied all filters to a 15MB TIFF file.

ZD CPUmark ₃₂ Score	ZD Winstone 96 Score	ZD CPUmark ₁₆ Score	Adobe Photoshop		
			Facet (seconds) ▼	Gaussian Blur (seconds) ▼	Unsharpen Mask (seconds) ▼
604	N/A	455	25.1	23.8	20.0
717	118	535	36.3	30.9	26.2
718	117	534	30.8	27.9	24.6
565	N/A	468	24.7	29.0	19.5
554	120	465	17.4	21.9	11.7
542	83	355	46.0	39.2	38.7
411	92	431	29.7	33.8	21.1
415	103	435	36.9	39.0	26.7
381	83	375	54.7	38.6	40.5
360	92	384	52.9	38.4	34.0

BETTER ►

BETTER ►

BETTER ►

N/A—Not applicable: We did not run the test on this machine

among many other features) to notify network administrators of hardware difficulties.

On our benchmark tests, the Deskpro 6000 posted an above-average score on the High-End Graphics WinMark 97 tests; all other scores were competitive. However, the Deskpro 6000's scores under Photoshop were some of the slowest of the roundup, on a par with the 233-MHz entries rather than its 266-MHz peers.

If you're willing to pay a bit more, the Deskpro 6000 would make a decent addition to your LAN.—CM

Deskpro 6000 M6266/4200/CDS. Street price: \$4,780. Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; fax, 281-518-1442; www.compaq.com.



Compaq Deskpro 6000 M6266/4200/CDS, Dell Dimension XPSH266.

Dell Computer Corp.

Dimension XPS H266



Although the Dimension XPS H266 (\$3,979 direct) looks like other units in this roundup, it sets itself above the rest. The 266-MHz Pentium II unit is the new flagship in Dell Computer Corp.'s Dimension line of value PCs: Its outstanding performance and features earn it an Editors' Choice.

The Dimension's mini-tower case was outfitted with a 6.1GB IBM hard disk, an Iomega 100MB Zip drive, a Matrox Millennium II graphics board with 8MB of WRAM, and an NEC 12X/16X CD-ROM drive. Its Intel motherboard offers two USB ports, an integrated audio subsystem, and a MIDI port.

The unit features a Dell-developed Windows 95 driver that supports a Pentium II feature called *write combining*. When this is enabled, writes from the CPU to the graphics board's video frame buffer are combined into large bursts instead of a series of short ones. We didn't test this feature, but Dell claims that it improves performance with some video-intensive apps.

The Dimension's scores on our benchmark tests were sterling. Its Graphics WinMark 97 and High-End Winstone 97

scores were the best in this roundup.

Included with the system is Microsoft Office 97 Small Business Edition, a 33.6-Kps U.S. Robotics voice modem, and a set of Altec Lansing ACS290 speakers.

The configuration, the driver, and the excellent scores make this unit a winner.—RSA

Dimension XPS H266. Direct price: \$3,979. Dell Computer Corp., Round Rock, TX; 800-388-8542, 512-338-4400; fax, 512-728-3653; www.dell.com. Circle 503 on reader service card.

Digital Equipment Corp.

Celebris GL-2 6233 ST

Although \$6,800 (street) is a serious price for a PC, the dual-processor 233-MHz Pentium II-based Celebris GL-2 6233 ST is a serious business machine. It offers the ease-of-service and network-management features that a business-oriented PC needs, and its performance on our Photoshop tests (which exercised both CPUs) was impressive. However, its scores on our benchmark tests (which used only one processor) reflected the overhead incurred by a second CPU.

The congested interior of the short tower reveals Digital Equipment Corp.'s efforts to design a muscle machine. The Digital motherboard slides out easily once expansion boards and wires are removed,

and it includes two USB ports, a MIDI port, and an integrated graphics subsystem based on a Matrox Millennium chip set with 8MB of WRAM.

The unit's Fast Ethernet and 16-bit FM sound cards are mounted on the inside of the case and connected to the motherboard with long cables. The system also included a 4GB Quantum Atlas II Ultra Wide SCSI hard disk and a 12X/16X Mitsumi CD-ROM drive. Digital's DMI software ClientWorks was bundled with the unit.

The Celebris performed extremely well on our Photoshop tests, bested only by the dual-266-MHz NeTpower Symetra2 Workstation. On our benchmark tests, however, the unit simply couldn't keep up. Its Business

and High-End Graphics WinMark 97 scores were the lowest among all single- and dual-CPU machines here; other scores were consistently near the bottom of the group. Overhead from a second CPU is a major factor to these low scores.

If you plan to do a lot of work with applications that exercise two processors, the Celebris is worth the price.—RSA

Celebris GL-2 6233 ST. Street price: \$6,800. Digital Equipment Corp., Acton, MA; 800-722-9332; faxback, 800-367-0436; www.windows.digital.com. Circle 504 on reader service card.

DTK Computer Inc.

DTK Apri-74M/K266

In a roundup full of fast drives, the \$4,310 (street) DTK Apri-74M/K266 offers the fastest CD-ROMs and one of the fastest hard disks. This representative Pentium II corporate system, sold through dealers and VARs, should be a good fit for its target market.

Housed inside the Apri's tool-free chassis is its most compelling component: a 10,000-rpm Ultra Wide SCSI Seagate Cheetah hard disk. Using this disk, the system produced a Business Disk WinMark 97 score that was 24 percent above the 266-MHz average. The unit's High-End Disk WinMark 97 score was also impressive, at 29 percent above average.

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- 17" Digital Monitor (18.1" viewable)
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- Matrox Millennium 3D w/4MB VRAM
- 17" Digital Monitor (18.1" viewable)
- 3COM 3c905 PCI 10/100 NIC
- Toshiba 16X Max 95ms EIDE CD-ROM Drive
- ATX Case
- 104-Key Keyboard With MS PS/2 Mouse
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CIRCLE 074 ON READER SERVICE CARD

Meanwhile, its Toshiba CD-ROM drive—which is listed as a 15X drive but actually runs at 10X speed on the average—was the fastest in our roundup on the ZD CD-ROM WinMark 97 tests. On the downside, the system performed poorly on our Business Graphics WinMark 97 tests with a Diamond Stealth 3D 3000 graphics accelerator card, but this was its only blemish.

The DTK Apri-74M/K266 ships with an ergonomic Microsoft Natural keyboard and is DMI-compliant, although it does not come with DMI software. It is otherwise a typical and adept Pentium II machine offered at a good price.—*CM DTK Apri-74M/K266*. Street price: \$4,310. DTK Computer Inc., City of Industry, CA; 800-289-2385, 818-810-0098; fax, 818-810-0090; www.dtkcomputer.com. **Circle 505 on reader service card.**

Gateway 2000 Inc.

Gateway G6-266



The Gateway G6-266 (\$3,349 direct) offers ample disk storage and a sleek and spacious mid-tower case and has the lowest price of the 266-MHz single-CPU units in our roundup. Gateway 2000 designs the G6-266 as a power multimedia system and bundles it with a set of large Altec Lansing ACS410 speakers and an ACS251 subwoofer. If you're looking for an affordable, cutting-edge, fully loaded PC, the Editors' Choice-winning G6-266 is an awesome pick.

This attractive unit (which has a removable panel that covers the unused external drive bays) was configured with a 6GB Quantum Fireball ST Ultra ATA hard disk and an STB Nitro 3D GX graphics board with 4MB of SGRAM. These components contributed to average scores on most tests, including our High-End and Business Winstone 97 tests and our High-End Graphics WinMark 97 tests. The unit was a below-average performer on the High-

Price of tested configuration For PCs sold through resellers, assume that street prices will be 15 to 20 percent lower than list prices. Some vendors factor this discount into their quoted prices; in such cases, we indicate that the cited price is a street price. All street prices are rounded to the nearest \$10. Some vendors sell directly to customers; such prices are listed as direct prices and are not discounted.

Hard disk interface or *Fast ATA-3* (also known as *IDE*) was the first industry standard for device interfaces used in hard disks. *Ultra DMA* (or *Ultra ATA*) drives support burst throughput of up to 33.3 MBps. *SCSI* drives use a different interface designed to minimize bus loading and disk I/O. Variations of *SCSI* include *Ultra SCSI* (also known as *SCSI-3* or *Fast-20*), which supports a maximum transfer rate of 20 MBps,

and *Ultra Wide SCSI* (also known as *SCSI-3*, or *Fast-40*), which supports transfer rates of up to 40 MBps.

Installed/maximum hard disk capacity We report the capacity in megabytes (units of 1,048,576 bytes). Some manufacturers quote millions of bytes (which makes the capacity appear to be about 5 percent larger).

Measured diagonal size In most cases, the vendor's claimed size of the monitor is larger than the actual viewing area.

Expansion-bus slots PCI cards and other peripheral device cards are stored in slots on the motherboard. PCI cards sometimes share a backplane with ISA cards, meaning that you cannot use both simultaneously. These shared slots are listed as *PCI/ISA*.

End and Business Disk WinMark 97 tests, mainly because of 10,000-rpm disk competition. Its Photoshop scores were in the running with the 266-MHz single-CPU units.

Also included are a Toshiba 12X/16X CD-ROM drive, a 56.6-Kbps U.S. Robotics voice modem, an Iomega Zip drive, a 17-inch Gateway CrystalScan monitor, Microsoft Office 97 Small Business Edition, and a bundle of MMX-enabled home and entertainment software.

The Gateway offers some fast and large hardware at an unbeatable price.—*RSA Gateway G6-266*. Direct price: \$3,349.

Gateway 2000 Inc., North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023; www.gw2k.com. **Circle 506 on reader service card.**

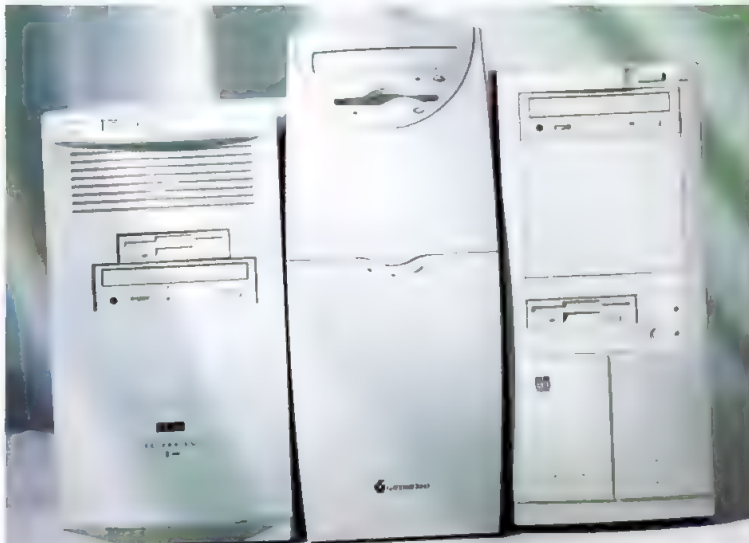
Hewlett-Packard Co.

HP Vectra VL 6/266

Unlike vendors that are putting the Pentium II into their high-end PC lines, Hewlett-Packard Co. is adding this CPU to its value line. The HP Vectra VL 6/266 (\$4,100 street) is for advanced corporate applications; it offers an easy-to-service design and a class-leading desktop management solution—HP TopTools.

Getting inside the Vectra VL is as easy as depressing a lever on the top edge of the bezel, removing the bezel, and then sliding off the cover. Security is not a worry. In addition to a case lock (with a handy key holder inside the bezel), the BIOS provides extensive password protection.

Servicing the interior is painless. Remove a metal bar from the front of the case and the HP-designed motherboard slides out at



Digital Celebris GL-2 6233 ST, Gateway G6-266, DTK Apri-74M/K266.

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SUMMARY OF FEATURES

Pentium II PCs

	AcerPower 9678NM+ Graphics Workstation	AST Bravo LC 6233	Compaq Deskpro 6000 M6266/4200/ CDS	Dell Dimension XPS H266	Digital Celebris GL-2 6233 ST	DTK April-74M/K266	Gateway G6-266	HP Vectra VL 6/266
■ YES ■ NO								
In alphabetical order by company								
Price of tested configuration (64MB RAM)	\$4,730 (street)	\$3,450 (street)	\$4,780 (street)	\$3,979 (direct)	\$6,800 (street)	\$4,310 (street)	\$3,349 (direct)	\$4,100 (street)
Processor	Pentium II/266	Pentium II/233	Pentium II/266	Pentium II/266	Dual Pentium II/233	Pentium II/266	Pentium II/266	Pentium II/266
Installed RAM type	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM
Hard disk	Seagate Cheetah ST34501W	IBM Deskstar DAQA-32160	Seagate Barracuda ST34371N	IBM Deskstar DHEA-36480	Quantum Atlas II	Seagate Cheetah ST34501W	Quantum Fireball ST	Western Digital Caviar AC34000L
Capacity and interface	4.2GB Ultra Wide SCSI	2GB ATA-3	4GB Ultra SCSI	6.1GB	4GB Ultra Wide SCSI	4.2GB Ultra Wide SCSI	8GB Ultra ATA	3.7GB EIDE
Graphics adapter	STB Nitro 3D	Matrox Millennium	Matrox Millennium	Matrox Millennium II	Matrox Millennium	Diamond Stealth 3D 3000	STB Nitro 3D GX	Matrox Millennium
Memory	4MB SGRAM	8MB WRAM	4MB WRAM	8MB WRAM	8MB WRAM	4MB VRAM	4MB SGRAM	4MB WRAM
Graphics chip set	S3 VIRGE/GX	Matrox MGA-2064W R1	Matrox MGA-2064W R2	Matrox MGA-2164W R0	Matrox MGA-2064W R1	S3 VIRGE/VX	S3 VIRGE/GX	Matrox MGA-2064W R1
Monitor (and measured diagonal size, in inches)	AcerView 78ie (15.8)	AST Vision 7L (15.5)	Compaq P70 (15.5)	Dell D1726T-HS (15.8)	Digital FR PCXBV-FZ (16.0)	MAG InnoVision DJ700 (16.0)	Gateway Crystal-Scan 700 (15.9)	HP Ultra VGA 1280 (15.5)
CD-ROM drive (speed)	Acer 616A-102 (12X/18X)	Torisan CDR-S112 (8X/16X)	Sony CDU311 (8X)	NEC 285 (12X/16X)	Mitsumi CRMCFX140S2 (12X/16X)	Toshiba XM-3801B (10X/15X)	Toshiba XM-6002B (12X/16X)	Hitachi CDR-8130 (9X/16X)
Sound adapter	Creative Labs Sound Blaster AWE64 PnP	None	Ensoniq ESS Audiodrive	Yamaha Wavetable OPL-4	Integrated ESS 1887	Creative Labs Sound Blaster 16 PnP	Ensoniq ES1370 AudioPCI	Creative Labs Sound Blaster 16 PnP
Speakers	Quickshot Sound Force 550	None	None	Altec Lansing ACS290	None	JUSTer AC-691N	Altec Lansing ACS410	None
Motherboard Components								
Motherboard manufacturer	Acer	Intel	Compaq	Intel	Digital	DTK	Intel	Hewlett-Packard
Chip set	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX
BIOS manufacturer and version (or date)	Acer 2.1	AMI 0.01.01DU01	Compaq (3/3/97)	AMI A00	Phoenix 4.05	AMI (7/15/95)	AMI 0.02.01.DTOT	Phoenix 4.05.8
Multiprocessor socket	■	■	■	■	■	■	■	■
Expandability								
Maximum RAM	384MB	384MB	192MB	128MB	512MB	512MB	128MB	192MB
Expansion-bus slots	2 ISA, 3 PCI, 1 PCI/ISA	5 ISA, 2 PCI	1 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	1 ISA, 3 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 PCI, 2 PCI/ISA
Front-accessible drive bays (5.25", 3.5")	3, 2	3, 1	2, 1	2, 3	3, 1	4, 2	3, 2	2, 1
Internal drive bays (5.25", 3.5")	0, 2	0, 3	0, 2	0, 2	0, 2	0, 2	0, 3	2, 0
Power-supply wattage	200W	200W	160W	200W	300W	250W	145W	200W
Parallel/serial/mouse ports	1, 2, 1	1, 1, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1
USB ports	■	■	■	■	■	■	■	■
Service and Support								
24-hour, 7-day live technical support	■	■	■	■	■	■	■	■
Standard warranty	3 years	1 year	3 years parts, 1 year labor	3 years parts, 1 year labor	3 years parts, 1 year labor	2 years	3 years	3 years
On-site service charge for 1 year	Included	Included	Included	Included	Included	\$50	Included	Included
24-hour turnaround for replacement parts	■	■	■	■	■	■	■	■

the flip of a lever. All slots are on a riser board, and removing the cards is a tool-free operation: Just unscrew and take out the metal bracket that holds them in from the back. The power supply flips out of the way to reveal a space that will accommodate either two fixed drives or one drive and an ISA board. The ribbon cables are labeled, so you'll know where to plug them back in once you're done. A road map details system-board switch settings.

The Vectra VL tested competitively.

Its High-End and Business Disk WinMark 97 scores were the lowest in this roundup, but for a 5,200-rpm device competing in a field of 7,200- and 10,000-rpm drives, it fared well. It also earned an above-average High-End Graphics WinMark 97 score and a better-than-average score on our Photoshop Unsharpen Mask test.

Businesses concerned with investment protection and cost of ownership won't go wrong with the Vectra VL.—*Carol Venezia*
HP Vectra VL 6/266. Street price: \$4,100.

Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; fax, 800-231-9300; www.hp.com.
Circle 507 on reader service card.

Micron Electronics Inc. **ClientPro XLU**

The ClientPro XLU is a network-ready 266-MHz Pentium II PC aimed at corporate installations. The attractively priced machine (\$3,599 direct) was a good performer on our tests and includes all the

COVER STORY
Pentium II PCs

its Diamond Stealth 3D 2000 Pro graphics board, loaded with the S3 ViRGE/GX chip set and 4MB of VRAM. The unit also came with a 16X IDE CD-ROM drive.

Combining strong performance, network readiness, and a good price, this Micron unit is hard to overlook.—*CM*

ClientPro XLU. Direct price: \$3,599. Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; fax, 208-893-3424; www.micronpc.com. *Circle 508 on reader service card.*

NEC Computer Systems Division

PowerMate Professional

NEC Computer Systems Division gains an admirable flagship for its corporate PowerMate series with the PowerMate Professional (\$4,750 street). The 266-MHz Pentium II unit posted average benchmark test scores and has strong network management capabilities. NEC's PowerMate series of corporate PCs offers DMI compliance and appealing multimedia features, such as high-end graphics boards and plenty of disk storage. NEC also bundles its own utilities with the system.

The PowerMate Professional was configured in a wide, easy-to-service, tool-free mini-tower case with a 4GB Seagate Barracuda Ultra Wide SCSI hard disk, a Number Nine Imagine 128 Series 2 graphics board with 4MB of VRAM, and an NEC 12X/16X CD-ROM drive. Access to the Intel motherboard, which offers two USB ports, a MIDI port, and integrated 16-bit FM synthesis audio by Yamaha, was unobstructed for the most part.

The system also comes with NEC's Desktop Manageability package, which includes Intel's LANdesk client management software and McAfee's VirusScan and WebScan data protection utilities. On the motherboard, NEC also includes its Magic Eye ASIC, which works with LANdesk to monitor for intrusion and send an alarm, if necessary. The PowerMate was a consistently average performer on our benchmark and Photoshop tests.

A good network management bundle and competitive performance mark this NEC corporate system.—*RSA*

PowerMate Professional. Street price: \$4,750. NEC Computer Systems Division, Mountain View, CA; 800-632-4636, 508-

Micron ClientPro XLU	NEC PowerMate Professional	NeTpower Symetra2 Workstation	Quantex QP6/266 SM-4X	SAG STA Pen II	Sys Performance Pro 266	ZDS Performance 266
\$3,599 (direct)	\$4,750 (street)	\$9,800 (street)	\$3,899 (direct)	\$4,070 (direct)	\$4,599 (direct)	\$3,899 (direct)
Pentium II/266	Pentium II/266	Dual Pentium II/266	Pentium II/266	Pentium II/233	Pentium II/266	Pentium II/266
EDO DRAM	EDO DRAM	EDO ECC RAM	EDO DRAM	EDO DRAM	EDO DRAM	EDO DRAM
Maxtor 84000AB	Seagate Barracuda ST34371W	Seagate Barracuda ST34371W	Seagate Barracuda ST34371W	Seagate Cheetah ST34501W	Seagate Cheetah ST34501W	Quantum Fireball ST6480AT
3.7GB Ultra DMA-33	4GB Ultra Wide SCSI	4GB Ultra Wide SCSI	4GB Ultra Wide SCSI	4.2GB Ultra Wide SCSI	4.2GB Ultra Wide SCSI	6GB Ultra DMA-33
Diamond Stealth 3D 2000 Pro	Number Nine Imagine 128 Series II	Matrox Millennium	Matrox Millennium II	Number Nine Imagine 128 Series II	Matrox Millennium	Number Nine Imagine 128 Series II
4MB VRAM	4MB VRAM	4MB WRAM	8MB WRAM	4MB VRAM	4MB WRAM	4MB VRAM
S3 ViRGE/GX	Number Nine Imagine 128 Series II	Matrox MGA-2064W R2	Matrox MGA-2164W R0	Number Nine Imagine 128 Series II	Matrox MGA-2064W R1	Number Nine Imagine 128 Series II
ADI 5V LM 1764 (15.8)	NEC MultiSync XV17+ (15.3)	Iiyama MF-8617E (15.5)	MAG InnoVision DX700T (16.0)	MAG InnoVision DX700T (16.0)	KDS (OEM) (15.8)	Sampo Alpha-Scan 760 (16.0)
Hitachi CDR-8130 (12X/16X)	NEC CRD-8160B (12X/16X)	Toshiba XM-5702B (12X)	Toshiba XM-5701B (12X)	Sony CDU-511 (12X/16X)	TEAC CD-512E (12X)	Toshiba XM-5702B (12X)
Integrated Yamaha OPL-3	Integrated Yamaha OPLSA	Creative Labs Sound Blaster 16 PnP	Integrated Yamaha OPL-3	Integrated Yamaha OPL-3	Creative Labs Sound Blaster 32 PnP	Integrated Yamaha JMF 715-S
Advent 007	Goldron (OEM)	Labtec LCS-600	Altec Lansing ACS400	Cyber Acoustics MMS-6	Midi Land ML165	Cambridge Soundworks
Intel	Intel	NeTpower	Intel	Intel	Giga-Byte	Intel
Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX
AMI 0.02.01 DT05	AMI 1.00.01 DT0K	Award 5.51PG	AMI 1.00.01 DT0	AMI 0.02.01 DT0	Award 4.51PG	AMI 0.01.01 DT0
■	■	■	■	■	■	■
256MB	256MB	512MB	128MB	256MB	768MB	256MB
2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 4 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA
2, 3	3, 1	3, 2	4, 1	3, 1	3, 2	2, 3
0, 2	0, 1	0, 3	0, 4	0, 1	0, 3	0, 2
230W	200W	175W	235W	200W	235W	235W
1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1	1, 2, 1
■	■	■	■	■	■	■
■	■	■	■	■	■	■
3-5 years parts, 1 year labor	3 years	3 years	3 years parts, 1 year labor	2-5 years parts, 2 years labor	1-6 years parts, 1 year labor	3 years
Included	Included	Included	Included	\$40	Included	Included
■	■	■	■	■	■	■

basic hardware and software you'll need.

Designed to be connected out of the box, the DMI-compliant mini-tower includes Intel's LANdesk and a 3Com Fast Ethernet card. An Intel motherboard is housed in the unit's tool-free chassis. The motherboard integrates 16-bit sound by Yamaha and two USB ports and offers two available ISA slots, one available PCI slot, and one open shared slot. Although its four SIMM slots collectively support up to 256MB of EDO DRAM, none were

left open for expansion in our test system (Micron will sell standard 64MB configurations with two 32MB SIMMs).

Unlike most of the other 266-MHz systems reviewed, the ClientPro uses an inexpensive 5,200-rpm, 3.7GB Maxtor EIDE hard disk rather than a high-end Ultra SCSI disk. That did not hurt the system's performance on our tests. It garnered average scores on most, except for a better-than-average timing on our Photoshop Unsharpen Mask test—thanks in part to

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NeTpower

Symetra2 Workstation

The reach of the Pentium II extends beyond the mainstream business sector. NeTpower's Symetra2 Workstation (\$9,800 street) is a network-ready, dual-processor midtower designed specifically for mechanical CAD professionals and digital media artists. With a pair of 266-MHz processors, it is particularly adept at running multithreaded applications.

The Symetra2, with its Intel EtherExpress PRO/100B network card, is ready to connect to your network; some data protection is afforded in the form of EDO ECC memory. Our review system included a Matrox Millennium graphics board, but NeTpower usually includes one of its own high-end TRUfx cards, which are based on 3D Labs' Glint technology (prices range from \$725 to \$4,000 more) and offer support for animation and virtual-reality development. The system also had a 4GB Seagate Ultra Wide SCSI hard disk and a 17-inch monitor.

Under our MMX Photoshop tests—which are partially multithreaded—the dual-processor Symetra2 far outperformed its competitors, earning the top

scores on all three tests. On our standard benchmark tests (which exercise only one CPU), the Symetra2 produced a High-End Graphics WinMark score that was below average for this roundup; most other scores were roughly average.

The Symetra2 is comparatively expensive, but if you suit it up with a high-end graphics board and the appropriate software, you'll have an impressive workstation.—*CM*

Symetra2 Workstation. Street price: \$9,800. NeTpower, Sunnyvale, CA; 800-801-0900, 408-522-5199; fax, 408-720-8558; www.netpower.com. *Circle 510 on reader service card.*

Quantex Microsystems Inc.

Quantex QP6/266 SM-4X

With strong graphics performance on our benchmark tests, the Quantex QP6/266 SM-4X (\$3,899 street), a midtower system from Quantex Microsystems, compares favorably with the other 266-MHz Pentium II-based multimedia machines in this roundup. Quantex, which designs its SM series of multimedia machines with large hard disks, powerful graphics boards, and high-end audio systems, aims them at both home and office PC users.

The QP6/266 included a 4GB Seagate Ultra Wide SCSI hard disk and an Adaptec 2940UW Ultra Wide SCSI controller, a Matrox Millennium II graphics board with 8MB of WRAM (4MB is standard; subtract \$150 from the price quoted above), and a Toshiba 12X CD-ROM drive. The Intel motherboard provides two USB ports, a MIDI port, and integrated 16-bit Yamaha audio circuitry with FM and wavetable synthesis. You'll hear everything clearly through a set of Altec Lans-



Quantex QP6/266 SM-4X,
NeTpower Symetra2 Workstation.

ing ACS400 speakers with an ACS250 subwoofer. The case had also three external 5.25-inch drive bays and three internal 3.5-inch drive bays open for expansion.

Not surprisingly, the unit logged above-average High-End and Business Graphics WinMark 97 results. It also tied for the best High-End Winstone 97 score of the roundup. All other scores were average, except for the Business Disk WinMark 97 score, which was below average.

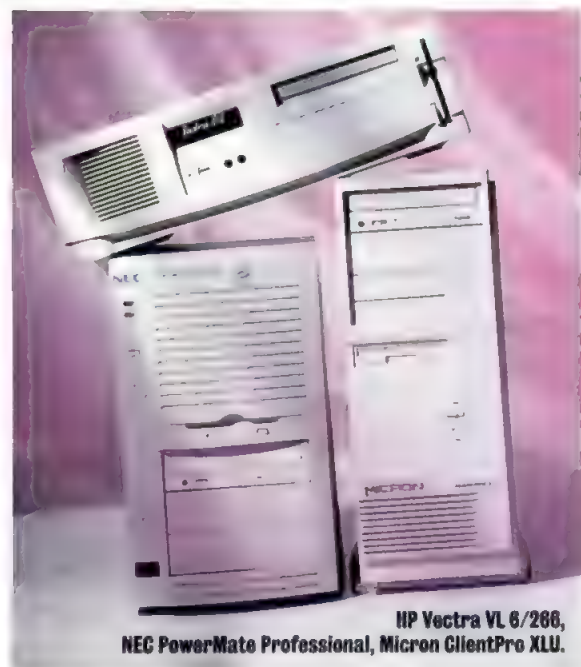
Also included with the system are a 17-inch Mag Innovision DX700T monitor and a 33.6/14.4-Kbps voice modem. The QP6/266 offers a good set of components and competitive performance at an attractive price.—*RSA*

Quantex QP6/266 SM-4X. Direct price: \$3,899. Quantex Microsystems Inc., Somerset, NJ; 800-346-6572, 908-563-4166; fax, 908-563-0407; www.quantex.com. *Circle 511 on reader service card.*

SAG Electronics

SAG STA Pen II

With its strong hard disk performance, the 233-MHz Pentium II-based SAG STA Pen II is a formidable office workstation. SAG Electronics, a custom builder of Intel- and Digital Alpha-based servers and workstations, designed the STA Pen II (\$4,070 direct) as an easy-to-service, secure corporate system. SAG specializes in high-speed storage and RAID systems.



HP Vectra VL 6/266,
NEC PowerMate Professional, Micron ClientPro XLU.

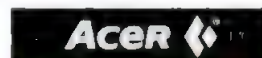


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SAG STA Pen II, ZDS Performance 266 with Pentium II Chip, Sys Performance Pro 266.

The STA Pen II's wide mini-tower case, which opens without tools, houses a 10,000-rpm, 4.2GB Seagate Cheetah Ultra Wide SCSI hard disk in a lockable slide-out drive bay, along with a Sony 12X/16X CD-ROM drive in a standard bay. The Intel motherboard offers two USB ports, DIMM and SIMM slots that can be used simultaneously, and a MIDI port. The unit was configured with a Number Nine Imagine 128 Series 2 graphics board with 4MB of VRAM and an Adaptec 2940UW Ultra Wide SCSI adapter.

The STA Pen II outdistanced the AST Bravo, the only other 233-MHz Pentium II-based system in this roundup, on most of our tests. Thanks to its fast disk subsystem, its Business and High-End Disk WinMark scores were above average. Most other scores were average, except for below-average results on our High-End Graphics WinMark 97 and Photoshop tests.

Bundled with the system were a 17-inch Mag Innovision DX700T monitor and a set of Cyber Acoustics bookshelf speakers. The unit is DMI-compliant but was not sent with supporting software (LANDesk is available from SAG for an extra \$25).

The STA Pen II is an appealing mix of good price and strong performance.—RSA
SAG STA Pen II. Direct price: \$4,070. SAG Electronics, North Andover, MA; 800-989-3475, 508-683-0339; fax, 508-689-0180; www.sagelec.com. *Circle 512 on reader service card.*

Sys Technology Inc.

Sys Performance Pro 266

With some of the best benchmark test scores in this roundup, the Sys Performance Pro 266 (\$4,599 direct) proved to be an excellent choice as a muscle 266-MHz Pentium II multimedia workstation. Its high-speed disk subsystem performance was especially noteworthy. The Performance line is the most powerful series in the company's lineup. Sys also sells Performance units with the new AMD K6 processor.

Our test unit featured a 10,000-rpm, 4.2GB Seagate Cheetah Ultra Wide SCSI hard disk, linked to an Adaptec 2940UW Ultra Wide SCSI adapter, and a Matrox Millennium graphics board with 4MB of VRAM. Unlike many other systems in this roundup, it used a Giga-Byte motherboard instead of an Intel unit.

The Sys Performance Pro 266 logged the best Business and High-End Disk WinMark 97 and Business Winstone 97 scores in this roundup. It also posted above-average High-End and Business Graphics WinMark 97 scores; other test scores were highly competitive as well.

Other admirable features included a 3Com Fast EtherLink XL 10/100-Mbps network card, a Creative Labs Sound Blaster 32 wavetable audio board, a Cardinal 33.6/14.4-Kbps fax modem (software upgradable to the U.S. Robotics 56-Kbps specification from Cardinal's Web

site), and a 17-inch KDS monitor. Clutter-free cabling makes the interior accessible.

Great performance and top components make this system an attractive buy.—RSA

Sys Performance Pro 266. Direct price: \$4,599. Sys Technology Inc., Cypress, CA; 800-613-9963, 714-821-3900; fax, 714-821-9592; www.systechology.com. *Circle 513 on reader service card.*

Zenith Data Systems Direct

ZDS Performance 266 with Pentium II Chip

The ZDS Performance 266 with Pentium II Chip, \$3,899 from Zenith Data Systems Direct, offers a reasonable package for the power business PC buyer. Its disk performance wasn't stellar, but its overall scores were competitive. ZDS aims the DMI-compliant system at corporate and home-office users who need the extra multimedia muscle provided by the 266-MHz Pentium II CPU.

ZDS configured its unit with a 6GB Quantum Fireball Ultra DMA-33 hard disk, a Number Nine Imagine 128 Series 2 graphics card with 4MB of VRAM, and a Toshiba 12X CD-ROM drive. The Intel motherboard offered two USB ports, integrated audio circuitry, and a MIDI/joystick port. The mini-tower chassis provided convenient tool-free access.

For the same price, the bundled U.S. Robotics Sportster 33.6/14.4-Kbps fax modem we received can be swapped for a 3Com 10/100 Fast EtherLink XL card. The system also included a Cambridge SoundWorks speaker and subwoofer system. A 17-inch Sampo monitor was also sent with our unit, and although we did not receive it, Microsoft Office 97 Small Business Edition is a standard bundle with this model.

The system posted mostly average scores on our benchmark and Photoshop tests, but its Business and High-End Disk WinMark 97 scores were below average.

Despite some poor disk performance, the Performance 266 will get the job done.—RSA □

ZDS Performance 266 with Pentium II Chip. Direct price: 3,899. Zenith Data Systems Direct, Boxborough, MA; 800-261-7926, 508-635-6700; fax, 508-635-6790; www.zdsdirect.com. *Circle 514 on reader service card.*

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Featured Computer Artist: Diane Fenster

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Ever since the news came out about the new Intel® Pentium® processor with MMX™ technology, savvy computer folk have been racing to get hold of it. After all, it's the best and fastest Pentium chip yet. MMX technology works wonders with multimedia, turns video into a life-changing experience, and even delivers richer Internet content. But which computer to buy? Well...ours. At least that's what *PC Magazine* thinks. In their review of twelve 200MHz systems, the Dell Dimension XPS M200s just won an Editor's Choice award for best business PC, and was named a price/performance leader. And in *PC Computing's* survey, the XPS – which they called "a multimedia powerhouse outfitted for business" – was judged the top performer (see graph). What can this mean? Probably just that in MMX technology, as in everything else, the race goes to the swift.



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JAVA CAN GIVE YOUR WEB PAGES AN animation jolt—and now you don't even have to know how to program. New software lets nonprogrammers create animated Java applets without writing a line of code. Drag an image or text box into a window and apply effects from a menu or toolbar and the program generates a Java applet for you, usually along with the HTML page you need to display it on the Web.

PC Magazine Labs tested six such applet-creation tools for Microsoft Windows 95, from simple products that offer precooked animated effects to full-scale development environments that let you build applets to interact with data-analysis scripts. All of the products target nonprogrammers, but some are not as user-friendly as others. Aimtech Corp.'s Jamba, for example, requires some familiarity with programming concepts to take advantage of its best features. In fact, you should have at least a basic understanding of

programming environments and concepts to use any of these products effectively. So we've put together a glossary to help you.

In these packages, you apply effects to objects—images, shapes, sounds, text strings, or even remote Web addresses. Effects can be as simple as bouncing an image within a set area or linking to another page, or as complex as collecting data from fill-in fields and transmitting it to a remote program. Standard visual effects include zooming, fading, embossing, and moving along a path. Effects can be triggered when an ap-

plet starts, after a set time, or when the user clicks on or moves the mouse over a specified region of the applet.

Most of the programs here are Windows applications, but two—Peak Technologies' JetEffects and Dimension X's Liquid Motion Pro—are standalone Java applications, and consequently they don't support standard Windows keyboard behavior. You may discover, for

By Edward Mendelson

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Java Applet Builders

example, that clicking on what you thought was a dialog's close button doesn't actually close it, or that you can't use the Tab key to move through dialogs.

Java applications can have more serious problems. Unlike applets, which typically run in a Web browser, standalone Java applications require a Java Development Kit (JDK) in order to run under Windows. JetEffects and Liquid Motion automatically install the Sun JDK to your hard disk, but if multiple versions of the JDK reside there, the programs might not run properly.

In spite of growing pains, Java already brings more power and flexibility to Web pages than any other tool for nonprogrammers.

Beyond the merits of a consistent appearance across platforms, a Java applet needs much less space than its animated GIF counterpart. And in that smaller space, you can implement visual and audio effects that once were available only to professionals. So join the ranks of Java nonprogrammers with one of these fun animation tools.



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WebMotion's interface offers excellent control.

Astound Inc.

Astound WebMotion

Astound WebMotion 1.0 (\$69.95 list), a 2-D Java animation designer, features excellent ease of use at a low price. WebMotion provides more power and functionality than Egor, and its Windows interface makes it easier to navigate than JetEffects or Liquid Motion. But though WebMotion is Java-enabled, it is a 16-bit program; it won't support long filenames, a potential problem for managing content.

The moving objects on your screen, or *actors*, can be images in a variety of formats, including GIF, JPEG, and TIFF. To create animations, or *movies*, you define lists of images using a preview function, with which you can rotate images and an-

imate text. WebMotion does not include an image editor, so you'll need to get one to use the product effectively.

If you can use a mouse, you can create movies: Drag and drop actors, and draw motion paths by hand or with lines or curves. A project window lists all of the actors in an animation, and a main window provides a visual look at your movie. You can preview movies in this window, stepping through frames at your own pace. You can control the frames for each actor independently, making it easy to freeze one object while others keep moving. You can associate actors with certain events, having them link to URLs, go to different frames, or play .AU files when they reach a certain position or are clicked by a user.

You deploy movies using a separate install utility. The installer creates the Java files through FTP, including GIF files on a local disk or a Web server.

The amount of downloaded Java code is remarkably small, taking up only 30K in our test applet.

You can easily create content for non-Java browsers by generating animated GIFs, though this means sacrificing sound and much of Java's efficiency; a GIF can consume up to 500K, as opposed to an applet's 30K. WebMotion's installer gener-

SUITABILITY TO TASK

Astound WebMotion

	Power	Ease
Animation	Good	Good
Business use	N/A	N/A
Deployment	Good	Excellent

JAVA APPLET BUILDERS

How to Read the Suitability to Task Boxes

We considered three primary tasks when evaluating these programs: how well a program built Java animations, whether it could serve as a business tool for building forms and the like, and how it exported an applet to a Web page.

Animation We consider the program's ability to sequence multiple images. Multiframe views and a time-line view are pluses, as are multiple layers within each frame for separate image and text levels. Programs that allow events—such as mouse location or time duration—to trigger other events fare better. We like programs that can build a user control panel into the applet. Programs that can create 3-D animations achieve a higher *power* rating. We also look for audio editing and synchronization tools and

an included image editor. You should be able to preview an applet within the program.

Business use Here we look at a product's ability to build forms and charts as well as enable data access and retrieval (sending data to and from a database). We like products that include templates and assist in creating a user-defined look and feel. We consider the ability to extend the product with new Java controls and code. Controls beyond the AWT—such as spin, progress, gauges, clocks,

counters, calendars, and tab or tree controls—are a plus, as are e-mail components (the ability to send e-mail from an applet, for example, as an answer to some selections). Programs designed solely to build animated applets receive an *N/A* here.

Deployment For this task we evaluate how the tool deploys an applet. The most important factor to consider is the granularity of the runtime class library. Also useful is the ability to create packages (collections of classes) that do not require uploading the entire runtime library for the use of only one function. Tools that deploy an applet with a single mouse click fare better in the *ease* rating. Being able to cut and paste or use a wizard to drop an applet into an HTML editor is a plus.

SUITABILITY TO TASK

Product name here

	Power	Ease
Animation	Fair	Good
Business use	Good	Excellent
Deployment	Poor	N/A
N/A—Not applicable: The product does not have this feature.		

GLOSSARY

Java Animation Jargon

Abstract Windows Toolkit (AWT) The Java API that gives programmers access to Java's graphics functionality (buttons, widgets, windows, and so on).

Applet A Java miniprogram that runs within a browser or viewer, usually as part of an HTML page.

Application programming interface (API) The commands and functions a system makes available to programmers to build compatible applications or applets.

.AU The standard audio file format supported by the Java API.

Cabinet file (.CAB) A Microsoft file format used to hold compressed files.

Cel A frame or layer of animation or images. A film-animation term, it refers to art drawn on celluloid sheets that are combined to create a single scene.

Cycle A repeating sequence of images that provides more screen time while using fewer resources. For example, a character running before a backdrop can be a cycle, as can the running itself. Also known as a *loop*.

Java application A standalone program, usually executed using the command line syntax *java myapp class*.

Java Development Kit (JDK) A set of tools, examples, help files, and source and class code for a given platform that provides an API so programmers can write Java applets and applications.

Layers Virtual working areas that let the animator create objects that are handled independently of other objects (such as backgrounds or separate moving images). Layers allow you to add or remove elements without affecting others.

Path An invisible guide that directs the movement of an object in an animation.

Spline A line drawn through a series of points that is based on a mathematical formula (Bezier, or b-spline, for example), used to create a smoothly curved line.

Sprite An image that moves or is animated. A sprite can encapsulate its own animation and be part of a larger animation.

ates a primitive HTML page for your applet but offers little assistance for advanced design.

WebMotion's online help includes an excellent tutorial, another bonus for a product that provides a lot of functionality at a bargain price.—*Richard V. Dragan*
Astound WebMotion 1.0. List price: \$69.95. Astound Inc., San Francisco; 888-427-8686; fax, 415-845-6201; www.astound.com. *Circle 441 on reader service card.*

Sausage Software

Egor Animator

Sausage Software's Egor Animator 3.1 (\$99.95 list)—named for the mad scientist's assistant—does help you bring images to animated life, but the program's bugs and interface problems

SUITABILITY TO TASK

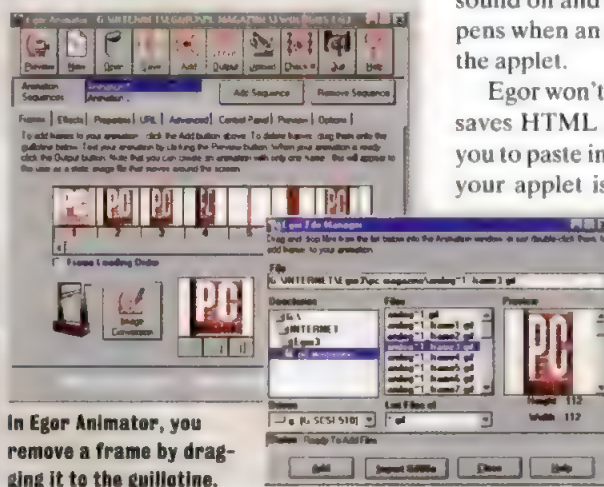
	Egor Animator	
	Power	Ease
Animation	Good	Good
Business use	N/A	N/A
Deployment	Good	Good

may make you think you're working with a monster. The program creates only Java animations

and animated GIFs; it can't build any other kind of Java applet. But Egor gets the job done via a simple interface that

doesn't require any programming skills.

All of Egor's functions are accessed from a single tabbed interface with a toolbar at the top. There's no top-line menu,



In Egor Animator, you remove a frame by dragging it to the guillotine.

but most features are accessible through keyboard shortcuts. A built-in converter translates standard graphics formats into GIF or JPEG files with user-selectable levels of JPEG compression.

You can create multiple animations with separate settings for each and specify whether the animations bounce or overlap when they meet, or cause the

browser to jump to another Web address. You can include a control panel next to your animation with buttons to change the animation's speed and direction, turn sound on and off, and control what happens when an object reaches the edge of the applet.

Egor won't create HTML pages, but it saves HTML code to the Clipboard for you to paste into an HTML editor. When your applet is completed, the program can upload all of the necessary files to a Web server.

Once you figure out Egor's cryptic menus, you can create animations easily, but watch out for bugs. If you quit the program without saving your

changes, Egor won't prompt you to save, and your changes will be lost. An option to preview files in multiple browsers forces you to find each browser on your hard disk manually. And when we tried to preview with the viewer in the Sun JDK, Egor crashed.

Egor Animator 3.1 is fast and flexible, but interface and reliability problems prevent it from being a top choice.—*EM*
Egor Animator 3.1. List price: \$99.95. Sausage Software, Melbourne, Australia; fax, 613-9663-1096; www.sausage.com. *Circle 442 on reader service card.*

Our Contributors: EDWARD MENDELSON is a contributing editor of *PC Magazine*. ANDREW BOSCARDIN is an editorial researcher at *PC Magazine*. RICHARD V. DRAGAN is a programmer at PC Magazine Labs. DAVID LIDSKY was the associate editor in charge of this story, and JAY MUNRO was the project leader.

Kinetix, a division of Autodesk Inc.

Hyperwire

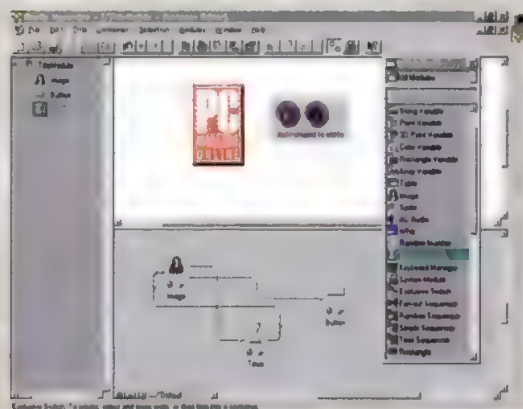


Delivering powerful features in a unique and creative environment, Hyperwire 1.0 (\$249 list), from Kinetix, lets you create simple applets quickly or undertake more sophisticated projects. The program delivers the broadest functionality of any of the products reviewed here, moving beyond 2-D Java into 3-D and applications development, while still being easy to master for basic animations.

You create your applets by wiring together modules, which can consist of

images, sounds, 3-D worlds—even equations or sequencers. The relationships between modules are defined by the wires that connect them. You can create a fully functional applet simply by joining two modules with a single wire. Hyperwire provides a wide selection of modules, including a sprite module for frame-by-frame animation, and you can also import your own modules.

Hyperwire's interface is organized into three panes plus the Module Panel, a



You build applets in Hyperwire by "wiring" components.

dockable toolbar that provides quick access to the components that will make up your applet or application. The left-hand pane provides a hierarchical view of the current project, while the rest of the screen is divided into the layout—pre-viewing how each component will appear—and the canvas or Wire view.

Editors' Choice

• Hyperwire 1.0



Creating Java applets for your Web site should be as easy as building Web pages in a WYSIWYG HTML editor. Only Hyperwire 1.0, from Kinetix, offers such

ease of use along with the power to build both Java animations and business-related Java forms, so it duly earns our Editors' Choice.

Hyperwire features an original, visually oriented approach to Java applet creation that sets it apart from its competition. You can create buttons and animations quickly or invest more time and produce full standalone applications. You are limited only by your creativity; you can create or import your own modules into the program, a feature that gives Hyperwire ultimate extensibility. To help you get started, Kinetix supplies a set of

linear, step-by-step tutorials.

Aimtech Corp.'s Jamba 1.1 deserves an honorable mention for its strong features for creating Java applets for business purposes. The program supports databases, drag-and-drop form building, and easy-to-build links to CGI scripts. Jamba is the only other program we looked at for this roundup that has the power of Hyperwire, though Jamba is not as easy to use.

Astound WebMotion 1.0 also deserves an honorable mention as an ideal tool for those Web designers looking only for a capable and easy animation tool. WebMotion makes the process of creating animations as easy as using a mouse.

Dragging an icon into the Wire view from the Module Panel makes it appear in the hierarchy and pops up a dialog for more information about it. Dragging the image module into the Wire view lets you import GIF or JPEG files, which you can then copy into the current project directory. This visual approach to creation is much more accessible than Jamba's form fields and Liquid Motion's Java interface.

Hyperwire makes publishing your project on the Web easy, generating all the HTML you need and saving it, along with copies of all necessary classes and libraries, as a single .ZIP file. For assistance, you can always refer to the solid help files and the informative, step-by-step tutorials.

Hyperwire 1.0 is a powerful yet manageable program that should appeal both to those who wish to create simple applets and to more advanced users who will appreciate the extended features.—*Andrew Boscardin*
Hyperwire 1.0. List price: \$249. Kinetix, a division of Autodesk Inc., San Francisco; 800-879-4233; www.ktx.com. **Circle 443** on reader service card.

Aimtech Corp.

Jamba

Aimtech Corp.'s Jamba 1.1 (\$295 list) creates multipage Java applets in a drag-and-drop, object-oriented environment. The program, with its ability to build applets that can call to databases for information, is one of the most powerful in this roundup. But its use of programming concepts may baffle users unfamiliar with the basic vocabulary of programming.

Jamba has a two-paneled interface; one pane displays thumbnails of your pages, the other shows the current page. To create text, a graphic, or another object, you click on a toolbar, then use the mouse to draw the outline of the object on the page. You associate actions with objects via a tabbed property sheet. This complex operation usually requires you to keep track of the properties of both the page and multiple objects. Objects that don't display on the page, such as audio files and remote URLs, can be placed on the pasteboard surrounding the active part of the page.

A separate

SUITABILITY TO TASK

Jamba

	Power	Ease
Animation	Excellent	Fair
Business use	Good	Fair
Deployment	Excellent	Excellent

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Source: PC World best overall PC company for reliability and service, December 1998.



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Java Applet Builders

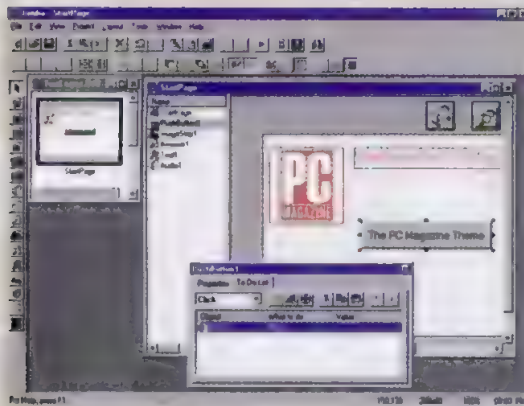
for Microsoft Internet Explorer or a .ZIP file for Netscape Navigator.

Programmers will like Jamba's easy-to-build links to CGI scripts and support for ActiveX objects and custom Java code. Jamba's database support and drag-and-drop form building is especially attractive for deployment on corporate intranets and Web sites.

Version 2.0, due in the second quarter of 1997, promises increased power plus much-

improved automation for non-programmers. The upgrade may be worth the wait, but anyone who isn't afraid to spend time learning can produce impressive results with this solid, reliable package.—EM

Jamba 1.1. List price: \$295. Aimtech Corp., Nashua, NH; 800-289-2884, 603-883-0220; fax, 603-883-5582; www.jamba.com. Circle 444 on reader service card.



Jamba looks like Visual Basic—no help to nonprogrammers.

image-manipulation utility adjusts color depth and image size, but you can't drag images from the utility to the Jamba editor; you must save the files first and then retrieve them in the editor. Jamba can't import animated GIFs; you must build filmstrip-style images, which the program imports into the editor, in which you set animation properties by hand. Publishing an applet outputs HTML and the player data, which a built-in FTP module uploads to remote sites. Player classes can be saved in a single .CAB file

Peak Technologies Inc.

JetEffects

PPeak Technologies' JetEffects 2.5b (\$49.95 list), formerly known as Peak Web Animator, lets you create animated 3-D effects via a spare and unintuitive interface. Written entirely in Java, JetEffects doesn't always adhere to Windows standards, such as using the Tab key to jump through a dialog box.

JetEffects applets can include images, text, and shapes that fade, zoom, become



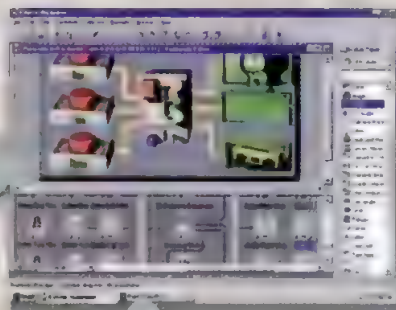
JetEffects' interface won't let you Tab through dialogs.

Building Your Own Java Applet

1 Plan and assemble materials.

The first step is to plan what you want to create and what action it has. Assemble all the necessary elements—images, sounds, or links—into a folder that your applet-creation tool can access.

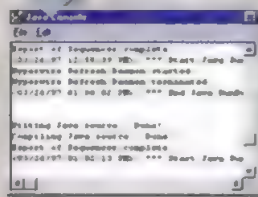
2 Build and assign actions.



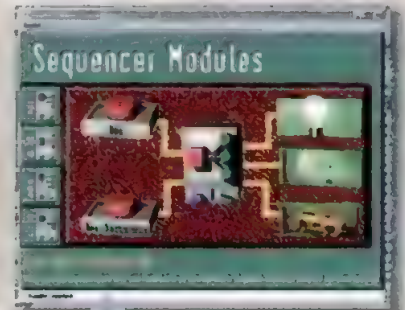
In the creation environment, assemble your elements and link them to events (timing or mouse clicks, for instance). Preview your creation to be sure it does what you want.

3 Compile code or build script.

The program creates the Java applet, usually at the press of a button. It creates a script of actions and elements and either gathers the required files or generates and compiles Java code for your animation. Your tool should also create a snippet of HTML code, so you can add your applet into your Web pages.



4 Publish and run.



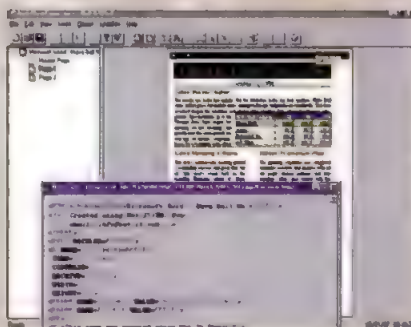
Copy the classes, HTML code, and content elements up to your server and view with your favorite Java-capable browser. Some packages may have publishing features and can also package the Java classes into .CAB or .ZIP files.

Creating Rich Documents with Java

Java is more flexible than HTML for building Web pages, but the tools available to publish on the Web with Java are only now coming of age. These products showcase the thriving Java-capable software market.

Having trouble with HTML tables? KL Group's **JClass LiveTable Applet 1.0**, which comes bundled with JClass LiveTable Pro (\$399 list), makes using tables in Web pages a snap. LiveTable lets you control the format of a Java grid component, including font and colors. You add data to a grid through HTML parameters in several ways. A powerful feature reads data files, parses them, and loads them into a grid. LiveTable supports resizing columns and scrolling and lets you add data, hyperlinks, and images to grid cells. The package includes full documentation plus sample code. (KL Group Inc., Toronto, Ontario, Canada; 800-663-4723; www.klg.com. *Circle 490 on reader service card.*)

The appearance of HTML can vary depending on the browser you use to view it. To overcome this, several vendors are using Java to publish content. Corel Corp.'s **Barista** technology, integrated into Corel Office Professional 7 (\$449 list), makes Web publishing easy and consistent across platforms. Corel hopes Barista will be a standard for publishing Web content the way PostScript is for print material. Unlike .PDF files, which require a separate viewer,



Net-It Now 1.5 converts output from Windows applications into Java-based Web documents.

Barista runtime files download during browsing. Barista also comes as an ActiveX control and as an SDK. (Corel Corp., Ottawa, Ontario, Canada; 800-772-6735; www.corel.com. *Circle 491 on reader service card.*)

FutureTense offers a powerful way to implement Java with **Texture 1.1**. This package (\$695 list) lets you create dynamic, Java-based content that can be updated from your server without rewriting HTML. Using a page-layout interface, you assemble visual elements, including text, graphics, and hyperlinks. Texture's drag-and-drop interface includes alignment tools and gives you good control over text flow. Using templates, pages grab content from the server during browsing. Texture includes a tool used to generate such simple interactivity on your page as scrolling, starting and stopping anima-

tions, and loading other URLs. The package ships with components for designing, building, and viewing pages in Java. (FutureTense Inc., Acton, MA; 508-263-5480; www.futuretense.com. *Circle 492 on reader service card.*)

If you can print it out, you can publish it on the Web using Java with **Net-It Now 1.5** (\$295 list), from Net-It Software Corp. Net-It Now installs a printer driver that captures output from most Windows applications—including word processors, spreadsheets, and illustration programs—and adds it to a Net-It Now project. You assemble Web pages using the printed outputs or other existing documents. Net-It Now comes with prebuilt components, such as hot spots, for displaying information. The package also lets you add interactivity between elements. For example, you can have one document pop up when a user clicks on a different one. This version of Net-It Now supports Marimba's Castanet technology, so you can update documents on the fly.

You can preview a document by running Net-It Now's Java applet viewer **jDoc Player** in any browser. Publishing a finished design is easy with built-in FTP support. Net-It Now comes with a tutorial to help get you started. (Net-It Software Corp., San Francisco; 888-638-4844; www.net-itnow.com. *Circle 493 on reader service card.*)—Richard V. Dragan

embossed, move along arcs or irregular paths, switch from background to foreground, play audio files, and link to pages at specified times or in response to mouse clicks. But confusing menus and inadequate help make this a package you should approach with caution.

The editing window displays your applet, with VCR-style controls at the top. At the bottom is a time line of horizontal bars; one bar represents the current object, and others represent effects, such as text color, that apply to the object. You can drag a bar to shift its posi-

tion, but you can resize it only by opening a cryptic dialog box in which you edit features of an effect.

To create an animation from graphics, you can't just import an animated GIF file; you must import each frame separately. In our tests, animated images we made sometimes disappeared, forcing us to start over. When we chose an elliptical

path for an image, the program shifted most of the ellipse past the screen's edge, despite attempts to move it back. Animation speed settings we entered into some dialogs had changed when

we reopened the same dialogs, and sometimes positive numbers inexplicably became negatives.

JetEffects saves your applet as an HTML file and associated data files but won't upload them to a server for you. Unless you want to upload all of the program's Java class files, you must figure out on your own which ones you don't need.

JetEffects 2.5b can produce attractive results, but there's no guarantee you'll get the exact effect you want.—EM

JetEffects 2.5b. List price: \$49.95. Peak Technologies Inc., Bellingham, WA; 800-453-5322, 360-733-6010; www.peak-media.com. *Circle 445 on reader service card.*

	SUITABILITY TO TASK	
	Power	Ease
Animation	Good	Fair
Business use	N/A	N/A
Deployment	Fair	Fair

Simply OUTSTANDING

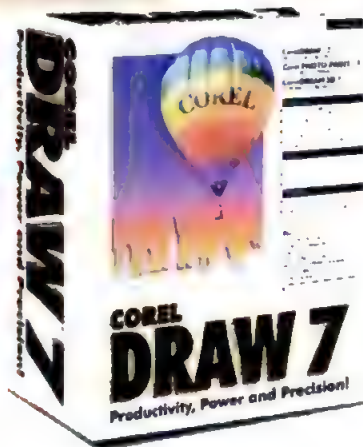
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Throughout CorelDRAW 7, you'll find impressive new ease of use enhancements.

Graphics artists who want a well-rounded suite should give CorelDRAW a close look.

CorelDRAW 7 is a full-featured graphics suite with state-of-the-art tools.

Windows Sources, January 1997

Draw 7 will be an excellent choice for any Web page designer. . . Draw 7 represents a real leap forward. . . Draw users will cheer. But I think the real story about Draw 7 is its accessibility to new users. If you've never used an illustration app before, Draw 7 makes it easy.

Government Computer News,
November 1996

Graphics professionals, take note: if you have the power, Corel has the program. CorelDRAW 7 is a feature-packed behemoth with something to please professional illustrators, graphic artists, and desktop publishers alike.

C/Net.com, November 11, 1996

CorelDRAW 7 is the most stable and well-developed version of the program yet. Corel has taken the strongest elements from previous versions—CorelDRAW, Corel PHOTO-PAINT, and CorelDREAM 3D—and made them easier to use, more reliable, and more unified as a suite.

PC Graphics & Video, December 1996

At this point, no other graphics program offers the breadth of features or comprehensive automation capabilities found in CorelDraw 7 Graphics Suite.

PC Magazine, February 18, 1997

For the first time in several years, CorelDraw's interface has changed significantly, yielding such innovations as a context-sensitive toolbar that alters according to the drawing tool you're using.

PC World, January 1997



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SUMMARY OF FEATURES

Java Applet Builders

■ YES ■ NO

Products listed in alphabetical order

	Astound WebMotion 1.0	Egor Animator 3.1	Hyperwire 1.0	Jamba 1.1	JetEffects 2.5b	Liquid Motion Pro 1.1
List price	\$69.95	\$99.95	\$249.00	\$295.00	\$49.95	\$725.00
Can create standalone applications	■	■	■	■	■	■
Can incorporate external applets	■	■	■	■	■	■
Supports ActiveX/OCX components	■	■	■	■	■	■
Can deploy ActiveX components	■	■	■	■	■	■
Can build forms/send e-mail	■	■	■	■	■	■
Can create applications to hook into existing back ends	■	■	■	■	■	■
Database support	■	■	■	■	■	■
Can create standard screens to be used as backgrounds or templates	■	■	■	■	■	■
Drag-and-drop form building	■	■	■	■	■	■
Prebuilt screens/templates	■	■	■	■	■	■
User can add templates	■	■	■	■	■	■
Proprietary preview/Browser preview	■	■	■	■	■	■
Auto-saves projects	■	■	■	■	■	■
Page/applet/animation wizard	■	■	■	■	■	■
Tutorial	■	■	■	■	■	■
JDK 1.1/JavaBeans support	■	■	■	■	■	■
Users can import their own Java extensions	■	■	■	■	■	■
Graphic editor included	■	■	■	■	■	■
Color reduction/Transparency control	■	■	■	■	■	■
Alignment tools	■	■	■	■	■	■
Audio file conversion	■	■	■	■	■	■
Hot-spot/image-map editor	■	■	■	■	■	■
Create multilayer cel animation	■	■	■	■	■	■
Can publish applets to the Web	■	■	■	■	■	■

PC MAGAZINE
EDITOR'S CHOICE

Dimension X

Liquid Motion Pro

Dimension X's Liquid Motion Pro 1.1 (\$725 list) is a useful 2-D-animation package, but it cannot measure up to its competition. It is not as extensible as Hyperwire, and it lacks WebMotion's simplicity.

You create animations—organized into *scenes*—which can contain GIFs and JPEGs, .AU files, and text (limited to Java's six available fonts). Scenes can embed other scenes for sophisticated animations. An image editor and sound-file editor are not included in the package, however.

In one panel, Liquid Motion lists a project's elements hierarchically. Another panel provides a graphical view of these elements, with a VCR-like interface for starting, stopping, and navigating a scene in real time. In general, you develop scenes visually by adding elements and tweaking their properties in a

pop-up window. You can add triggers that stop or start an animation when it's clicked or when it reaches a specified point or another element. A powerful feature lets you add a hyperlink to an element.

Liquid Motion's Java interface doesn't follow Windows conventions, making our experience less smooth than we would have liked. Still, the package does give you excellent control over animation methods, such as looping or reversing a series of images. You control movement

by adding lines, splines, jumps (for series of positions), and even wandering sprites.

For deploying your animation, Liquid Motion writes all the necessary runtime files to a local directory or to your Web server via FTP.

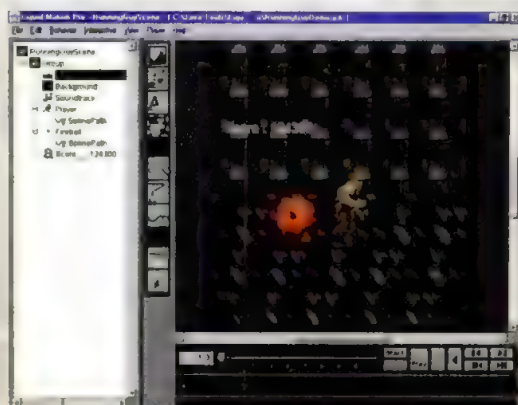
The program uses both Java and ActiveX to do its work, deploying all the necessary

SUITABILITY TO TASK		
Liquid Motion Pro		
	Power	Ease
Animation	Good	Good
Business use	N/A	N/A
Deployment	Fair	Good

Java class files along with a .CAB file for the Liquid Motion ActiveX component. Liquid Motion generates a default HTML file but has no provision for placing a link to an animation inside a preexisting page.

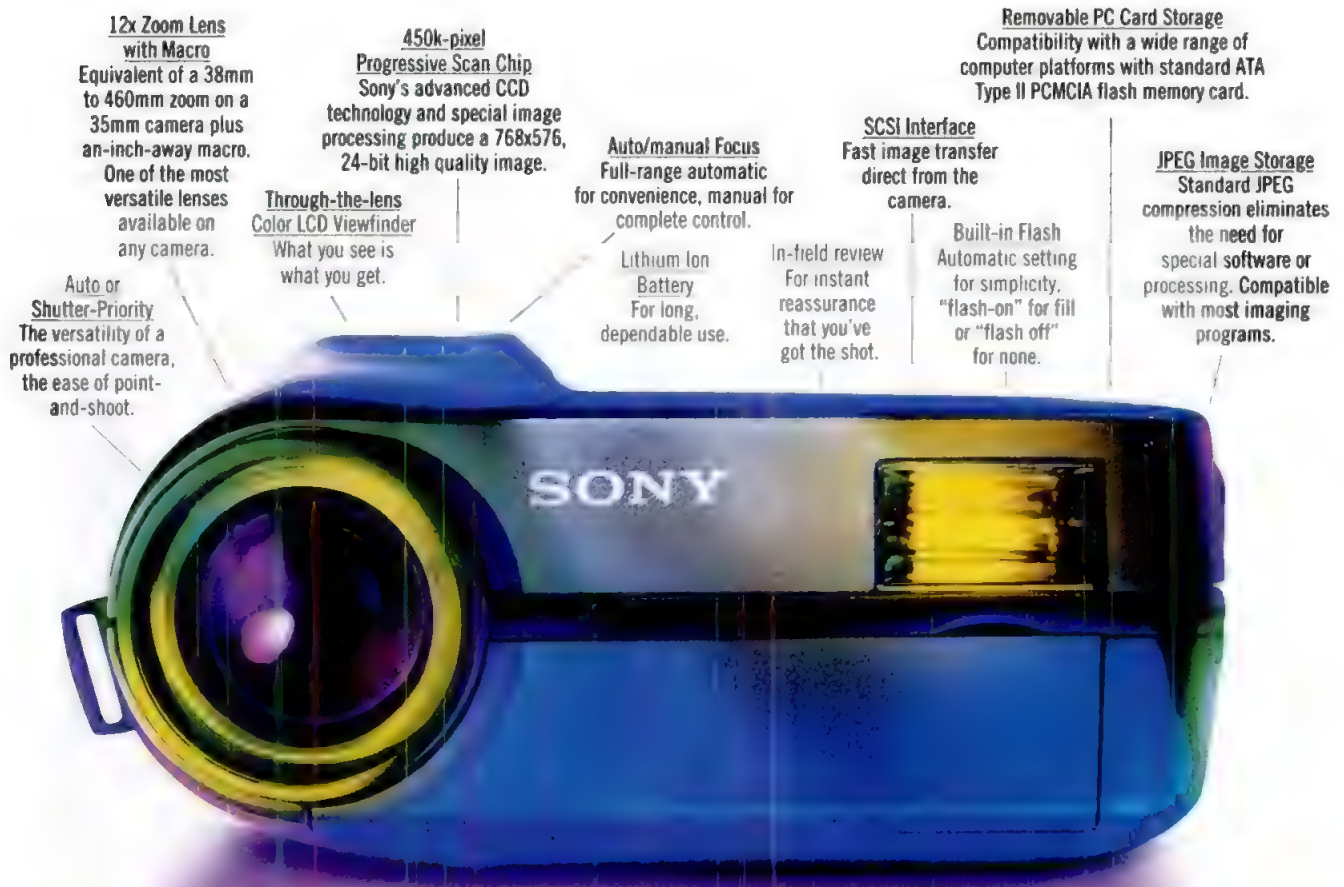
Liquid Motion's online help and tutorials were adequate for getting us up and running quickly. Though this is not a particularly extensible package—it provides no way to incorporate other Java applets or ActiveX controls—what Liquid Motion does, it does very well.—RVD □

Liquid Motion Pro 1.1. List price: \$725. Dimension X, San Francisco; 888-369-5282; www.dimensionx.com. Circle 446 on reader service card.



Liquid Motion Pro lets you navigate animations easily.

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The Intranet CHANNEL

The hottest new Internet technology pushes onto corporate networks. Push systems are fun, but do they give your company a useful information management tool?

By Todd Spangler

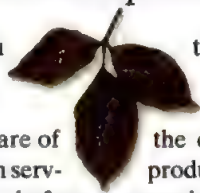


he premise of push, perhaps the most popular idea to spring from the Internet since HTML, is irresistibly simple: Information finds *you*. Push networks, the theory goes, turn the traditional “pull” information-retrieval model on its head. To find information the old-fashioned way, you have to initiate your search at an arbitrary starting point, and the information you turn up might be dubious or dated. And even if

you think you know where to look, you might have missed some important information that's now old news.

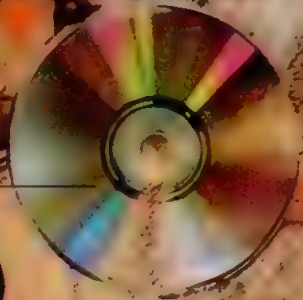
Push, by contrast, is constantly aware of your information profile. Ideally, a push server will deliver exactly what you need, before you realized you were looking for it. Traditional networks are passive storage bins—more like libraries—whereas push networks are alive and dynamic personal assistants.

The current push craze grew out of Internet-based content services. PointCast was the first of these, delivering a host of various news and information channels in a slick interface. You installed



the software, indicated which topics you were interested in, and PointCast took care of the rest, automatically updating the content on a scheduled basis. Similar products soon followed, and today there are more than a dozen push clients for receiving general-interest information over the Internet in scrolling tickers, screen savers, pop-up messages, or Web pages. (See the sidebar “What’s Push?” for a comparative grid of push products.)

At times, the buzz on push has grown so loud that some frenzied observers have predicted the death of the Web browser. But to paraphrase Mark Twain: Rumors of the Web browser's



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How Push Servers Work

Push servers actively distribute information and applications that match your interests, as opposed to Web servers and file servers, which passively wait for you to find what you're looking for. Here's an overview of how push servers operate in an internal corporate network.

1

INTERNAL CONTENT CREATION

Push content is grouped together in individual channels. The administrator or the person responsible for creating channel content generates the necessary files or information—anything from a simple text message to a Java application—and submits the content to the server to be broadcast.

CHANNEL: Company News
Item 1: New 401K Options
Item 2: Quarterly Earnings

DIRECTORY
CHANNEL: Company News
CHANNEL: Sales
CHANNEL: Human Resources

CHANNEL: U.S. News
CHANNEL: Sports
CHANNEL: Stock Quotes

2

SUBSCRIPTION

From a centralized directory, a network user subscribes to channels of interest. (The user must have a compatible push client installed.) Some push servers allow the administrator to password-protect channels, to be accessible only to specified individuals.

NEW!
CHANNEL: Company News
Item 1: New 401K Options
Item 2: Quarterly Earnings

3

NOTIFICATION

The user receives updated content in one of two ways:

- The push client software automatically polls the server at a specified interval.
- The server sends out the information immediately and the push client software—which is always "listening"—receives the broadcast.

4

EXTERNAL CONTENT SERVICES

Most push products today supply preconfigured channels of general-interest news and information. To access this content, the push server caches the channel information from the Internet locally, acting as a proxy server so that network clients don't need to access the Internet for every update request.

death have been greatly exaggerated. The next version of Microsoft Internet Explorer, Version 4.0, and a future version of Netscape's Internet client, called Netcaster (formerly known as Constellation), will both incorporate push features that enhance, not replace, the Web browser as an information-harvesting tool (see "The Push Desktop: Coming Soon" in this feature). These push desktops—along with Microsoft's proposed standard for push, the Channel Definition Format (CDF)—will be the first step toward ubiquitous use of push content. Netscape, though, doesn't believe a separate push standard is necessary, and will use HTML, Java, and JavaScript to deliver content to Netcaster.

THE INSIDE PUSH

As push technologies on the Internet mature, the next phase of push focuses on products for internal corporate networks. In this feature, *PC Magazine* looks at four push servers designed to be used internally: BackWeb, Marimba's Castanet, Wayfarer's Incisa, and the PointCast I-Server. (Softbank, the parent company of both Ziff-Davis Publishing and *PC Magazine*, has invested in both BackWeb and PointCast.) All four of the systems we reviewed require their own proprietary clients. To reduce the amount of traffic running over the wide-area link to the Internet, all the push servers include a proxy server feature or option to cache data from the Internet locally (though BackWeb's and Marimba's proxy servers were in beta at the time of our review).

Push servers allow businesses to set up

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and broadcast their own information channels, in addition to being able to receive Internet channels. Just as network administrators began using Web browsers and Web servers on internal corporate networks, now they are moving push servers to the intranet. The advantage of using push for distributing information over an intranet is to deliver the appropriate information immediately to people who can use it. However, someone in the organization must manage these push servers and create content for them. In addition to company-generated content, a network administrator wants his users to receive external information that's relevant to their job functions.

While timely delivery of corporate information is important to network users, many companies also need to distribute applications to lots of users, a task that becomes extremely costly and difficult when the software needs to be upgraded or re-

placed. A new kind of push server system, embodied by Marimba's Castanet, is designed to distribute and manage applications automatically. BackWeb provides software distribution through its system, but it doesn't provide an entire framework for distributing and running programs as Castanet does.

CHANGE THE CHANNEL

Although each of these four servers calls itself a push technology, we found significant differences among them. Marimba's Castanet, especially designed to deliver and maintain applications, offers a unique and technically innovative management system. When it updates an application, Castanet sends only the data that has changed, which minimizes network traffic. But since the product is built around Java, Castanet is a good choice only for networks that are using network-based Java applications or are considering them. A future version of Castanet should support non-Java applications.

The three other servers focus on distributing messages and Web pages. PointCast, the grande dame of push, sticks to its knitting and basically provides a proxy server in PointCast I-Server for the service's news and information content, and it allows a company to set up its own PointCast channel. It provides great administration tools but not much flexibility in what you can broadcast.

BackWeb has much more diverse content-delivery capabilities, but with that power comes more complexity than with PointCast or Wayfarer's Incisa. While the

HIGHLIGHTS

Push Servers

E-mail is still the best push technology for delivering time-critical information to a specific audience, but the push packages reviewed here give us a first glimpse at the future of information management. Push will move from being a cool desktop toy to being a serious information tool that changes the look and function of the desktop.

Incoming data Since the debut of PointCast, push clients have been equated with Internet-based services that deliver information—or eye candy, to push detractors—via screen savers and stock tickers

running along the bottom of your screen. But information can be pushed to the desktop in all shapes and sizes, including Java applets, pop-up alerts, HTML links, and Shockwave animation. Users can then click to follow links to news- or business-related notifications.

Across the channel Data comes to the push client via specific channels. Several of the products reviewed here allow you to pick and choose which channels your push client will be tuned to, and administrators can build their own channels for intranet use. Keep in mind, though, that someone will

have to be responsible for that channel's content.

Push comes to shove Many push servers actually use a pull technique, in which the client software sends out a request periodically for updated information. Of the products we looked at, only Wayfarer's Incisa uses a multicast approach to send messages to clients. But functionally, users don't see a difference unless the information really is needed instantaneously (such as in a real-time financial services application). In many cases, systems that use client polling have a minimal impact on network performance as long as clients are connecting to a local proxy server.

company claims BackWeb offers software distribution, BackWeb provides a simple file download quite unlike the application distribution of Castanet. Wayfarer touts the fact that its Incisa system is completely designed for intranets, and it includes no advertising as PointCast does.

In the end, we found it difficult to see what value message-oriented push servers add over a more common push technology: e-mail. (Marimba's solution, by contrast, can provide an excellent way to push applications in an enterprise network.) Your company most likely uses a groupware or e-mail system to distribute time-sensitive information and files. (See the sidebar "Groupware as Push Servers" for a more detailed discussion.) Except for their ability to act as proxies for Internet news feeds, push servers that simply broadcast messages may be redundant for most networks. And while we initially liked the flashy, eye-catching quality of the broadcast messages, eventually they grew irritating.

There were some products we didn't include in our main roundup. Diffusion's IntraExpress is a message-broadcast system that uses a variety of output methods for distribution (see the sidebar "IntraExpress: Pushing Beyond the Network"). Dazel's MetaWeb, which is supposed to have features similar to IntraExpress, was not available to review. Three other push server products—DataChannel's ChannelManager, Intermind's Dynamic Publisher, and Verity's IntelliServ—weren't shipping in time for our roundup (see the sidebar "Other Products in the Pipeline"). We didn't review FirstFloor Smart Delivery, which is sold to software developers.

TRUE PUSH VS. CLIENT POLL

One of the ironies at work here is that many of the products that we've referred to as push products are technically exactly the opposite. Three of the products in our main review (BackWeb, Castanet, and PointCast) each initiate a request to the push server at a specified interval, a process referred to as client poll. The only true push product in our roundup is Wayfarer's Incisa, which uses a multicast approach.

Our Contributors: LES FREED and TONY POMPILI are contributing editors of *PC Magazine*. ERIC HARPER is a networking consultant and freelance writer. RICHARD V. DRAGAN is a programmer at PC Magazine Labs. TODD SPANGLER was the associate editor in charge of this story, and JEFFREY G. WITT was the project leader.

EDITORS' CHOICE

• E-mail for now



Our roundup of push servers caught the first generation of products in the midst of making the transition from Internet toys to corporate tools.

None of the products here offers a compelling solution for broadcasting just content over a corporate network. We think that most corporate networks are better off using standard e-mail to broadcast information and files across the network. You probably have an e-mail infrastructure in place, and your network users are most likely using it in a broadcast context already. Eventually, however, we expect to see smarter push services that will be oriented around pushing information into specific applications (such as delivering statistics into an Excel spreadsheet) or, like Marimba's Castanet, the applications themselves. And as push becomes integrated into the next generation of Internet clients from Microsoft and Netscape, we'll see more customizable push capabilities.

Some companies may find value in the

external news and data provided by PointCast, BackWeb, and Incisa. But companies must also weigh the negative productivity effects of setting up a persistent, distracting application that probably is peripheral to an employee's work duties. In PointCast's case, you're also displaying advertising to your employees. For core business needs, many will prefer to use corporate information services or commercial news feeds.

Marimba's Castanet deserves an honorable mention for its innovative technology for application distribution. But today, it is mainly administrators interested in deploying Java-based applications who will find value in Castanet. The product's unique ability to distribute self-managing applications, coupled with its sophisticated replication and updating scheme, makes it the most interesting and promising of the push systems that we reviewed.

Instead of requiring clients to check repeatedly for new content, Incisa sends one message that gets routed to all recipients. Other companies that have developed similar multicast technologies include StarBurst Communications and TIBCO, which has licensed its message-routing technology to DataChannel, Diffusion, and Intermind, among others. Multicast push servers are certainly more efficient, but to most users the slightly greater network traffic generated by poll-based solutions probably won't even be noticed.

Another irony is that push isn't entirely a new idea. As we've implied, e-mail can be considered a push technology, and Internet mailing lists are an example of barebones information push.

Push is all but inevitable, given its rivalry with the next generations of Web browsers. The challenge is how to make

push work for your network. Read our reviews to see whether one of these servers would be a good pick for you to start broadcasting over your intranet.

BackWeb Technologies Inc.

BackWeb

BackWeb calls its product "personalized broadcasting software" for the Internet. Following this analogy, the TV set—the BackWeb client software—is free. To put your own show on the air, you'll need the transmitter: the BackWeb server. BackWeb 1.1 lets you create a powerful information-distribution system, but as with Incisa and PointCast, e-mail is a better solution for broadcasting messages over your network.

The BackWeb client is available for Microsoft Windows 3.x, Windows 95, and Windows NT Workstation. A Mac version should be available by the time you read this. The server runs on Solaris or Windows NT; we tested the Windows NT version. Server pricing varies according to

the amount of data transmitted, but pricing begins at \$10,500 for one channel-server license and increases depending on your usage.

As its name implies, BackWeb works like a Web server in reverse. The BackWeb client allows you to choose which channels you want to receive. These can be a mix of public channels available on the Internet and private channels transmitted over your corporate intranet. Unlike PointCast, BackWeb did not provide a proxy server for Internet-based BackWeb content channels, but it will have one available free of charge for anyone to use by the time you read this.

When you install the client software, you can connect to BackWeb's Web site and select from a list of public BackWeb channels. At the time of our roundup, there were about 50 BackWeb channels—including those from Infoseek, Yahoo!, and ZD-Net—but the company plans to have more than 1,000 by the end of the year. BackWeb also recently announced an agreement with Microsoft to include a version of the BackWeb client in the final version of Microsoft Internet Explorer 4.0.

The BackWeb client runs as an icon in the system tray, polling and gathering data from BackWeb channel servers. When you

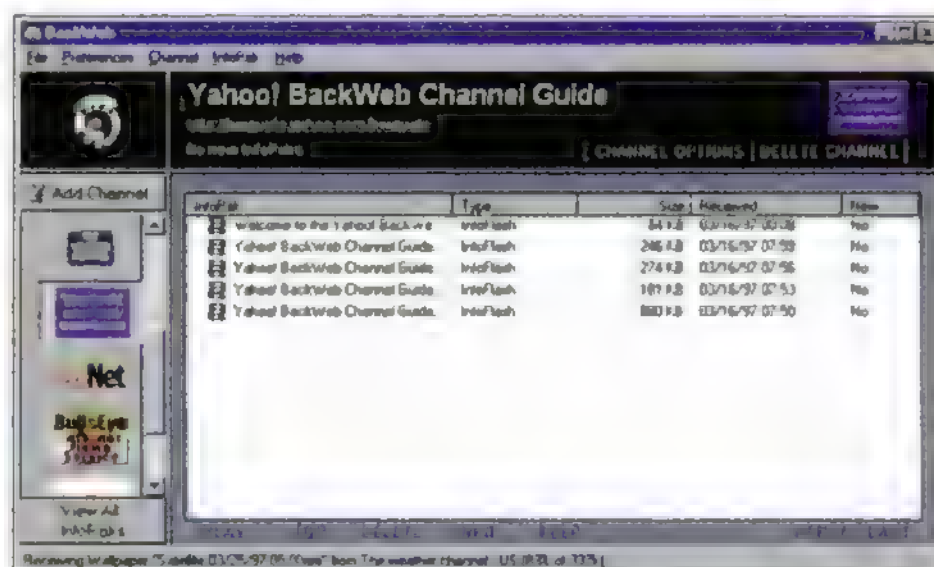
click on the icon, it brings the client to the foreground, showing you a list of new items, called InfoPaks, received from the servers. When you double-click on an item, BackWeb launches that InfoPak.

You can also set BackWeb to launch InfoPaks automatically when it receives them or change your screen saver on the fly (if you receive an InfoPak that contains appropriate content). Any InfoPak can be designated as an alert, called a Flash, and the client software can be configured to display Flash InfoPaks as soon as they arrive.

An InfoPak can contain text, sound, graphics, URLs, HTML code, screen savers, bitmaps, or even executable files (though BackWeb can't automatically launch executable files). This ability to transfer any type of file makes it possible to use BackWeb as a simple software-distribution system. Antivirus vendor McAfee Associates has a BackWeb channel to distribute virus updates, and several other software vendors are preparing BackWeb channels. The software-distribution capability of BackWeb is very different,

however, from that provided by Marimba's Castanet. Unlike Castanet with its active Java applications, BackWeb just distributes files.

The BackWeb server allows you to set



BackWeb's client interface displays your subscribed channels on the left and lists received InfoPaks in the main window.

up and manage your own channels. The BackWeb server consists of three parts: the server engine itself, the server console, and an editor for BALI (the BackWeb Authoring Language Interface). The server console program, which runs on any Windows 95 or Windows NT PC attached to the network, allows you to add and delete InfoPaks and provides tools that allow you to control the behavior of InfoPaks. For example, you can

HOW WE TESTED

Push Servers



Push servers promise to provide new ways of distributing information. We found that the products massed together in this category come with dissimilar approaches and technologies for solving this problem in many different ways.

Though much of the initial interest in push has been sparked by content delivered through the Internet, we evaluated these servers in the context of use within business networks. Given the diverse nature of these products, we tested features that apply across the board: administration, information publishing, accessing existing information assets, and each vendor's push architecture. Our purpose was to determine how well each product enhanced business productivity.

We set up each push product on Microsoft Windows NT Server 4.0 with Microsoft's Information Internet Server to test each product's interaction with an existing Web server. Our testing concentrated on the software's back-end capabilities, but we also installed each system's client to examine its customiza-

tion and the usefulness of the delivery format.

To evaluate administrative tasks, we looked at the methods for setting up broadcast channels and what was required to establish or associate content with each channel type. We looked for any features a product offered to take advantage of existing security and directory information available in the operating system. Our testing assessed the server's activity monitoring and logging capabilities as well as the tool's offerings for viewing or sorting information. We looked for the ability of each implementation to manage multiple servers from anywhere on the network. Of the products we tested, only PointCast I-Server offered the ability to access administrative functions through a Web browser. All the products provided Windows-based management consoles.

These products differed significantly in their information delivery methods, but all of them offered the ability to access Web content, send messages or notifications, and automatically update client software. We tested any included content-creation tools or scripting capabilities to determine how difficult it is to publish new or existing content. We preferred data-packaging methods that weren't proprietary and allowed the use of third-party tools. In our analysis of server architecture, we expected the servers to cache any data request from the outside to reduce traffic going across the firewall. We took into consideration software-specific transport schemes that included data compression and the ability to send updates to previously received data.—Jeffrey G. Witt

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Two Low-Profile Satellites, One Powered Subwoofer
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**Call for details on x2 Technology upgrades.*

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19.7" Viewable, .30 grille pitch, 95kHz, Supports Non-Interlaced Resolutions of up to 1600 x 1200
- **Full-Sized, 12-Bay Tower Case**
200-Watt Power Supply
- **104+ Keyboard**
- **Microsoft® IntelliMouse™**
Rolling Ball Between Buttons allows Scroll, Pan and Zoom
- **TR4 4GB SCSI Tape Backup Unit**
Up to 8GB Compressed, Maximum Data Transfer Rate of 30MB per Minute, One Tape Included
- **MS® Windows® 95 & MS Office 97, Small Business Edition Plus Encarta® 97**
- **MMX™ Technology-Enhanced Software Bundle**
- **Gateway Gold™ Premium Service & Support for Desktop PCs**
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control the time, date, or number of times an InfoPak is displayed, and you can also tailor InfoPaks for users who have specific computer types, display resolutions, or multimedia capabilities.

The BALI scripting editor is used to build the notification flashes that alert clients to the existence of new information. Flashes may use graphics, animation, and sound; you use BALI to tell BackWeb how to display the flash message elements. BALI scripts can call on external resources such as Java applets, QuickTime, or a Web browser to access services not provided by the BackWeb client software itself.

Though very flexible, BALI scripts can be very complex. BackWeb provides several examples as a starting point for building your own scripts, and the excellent printed manuals contain detailed information on BackWeb and BALI.

BackWeb incorporates a technology the company calls Polite Agent, which ensures that client updates take place only when the client's IP connection is otherwise idle. It can start and stop updates on the fly to allow other traffic to pass at full speed. This relieves congestion on individual workstations but doesn't help to reduce the overall traffic out to the Internet; when it ships, the BackWeb proxy server will alleviate this problem.—*Les Freed*
BackWeb 1.1. List price: Client, free; server, \$10,500 and up. BackWeb Technologies Inc., San Jose, CA; 408-437-0200; www.backweb.com. *Circle 447 on reader service card.*

Marimba Inc. Castanet

Marimba's Castanet is quite different from the rest of the products in this roundup. Though message and Web-page delivery is the focus of the other products, that's just one application of Castanet. Castanet's focus is distributing Java applications. With Castanet (\$1,000 list for 100 Tuners per hour), you can tune in to a channel that broadcasts news updates. But a Castanet channel can just as easily send you a product catalog or a word processor written in Java. Therein lies its limitation: If you neither currently use nor plan to use networked Java applications, Castanet is not for you. On the other hand, Marimba does pro-

WHAT'S PUSH?

Push has been used to describe a wide spectrum of products and services. Generally, it refers to a system in which a user receives information or applications automatically from a network server. But how it happens and what's being delivered varies a great deal among different push implementations.

In the chart below, we've segmented the current push market into two general categories: *products* and *content providers*. In this roundup, we take a look at the push products in the first category. These are intended for use on a corporate network and are sold as client/server packages. The second category consists of services that broadcast general-interest content over the Internet (with the exception of AirMedia, which sends data via radio transmission). Most of these

content services let you download the client and subscribe to information sources free. Some companies—including BackWeb and PointCast—try to span both worlds, providing products as well as content services.

While most push products require a proprietary client and server component, server-based push technologies don't require any special client software to use. These deliver information via e-mail or standard Web browsers.

A third type of push, the inverse of this client-independent push schema, is the "push desktop"—coming soon in Microsoft Internet Explorer 4.0 and Netscape Netcaster. These next-generation clients will provide a single interface to access multiple push sources. Lanacom HeadLiner provides similar server-independent push today.

THE PUSH BREAKDOWN

Intranet Products

BackWeb
(www.backweb.com)
Marimba's Castanet
(www.marimba.com)
FirstFloor Smart Delivery
(www.firstfloor.com)
Wayfarer's Incisa
(www.wayfarer.com)
Intermind Dynamic Publisher¹
(www.intermind.com)
PointCast I-Server
(www.pointcast.com)
Lotus Domino Broadcast
(domino.lotus.com)

Internet Content Providers

PROPRIETARY CLIENT AND SERVER

After Dark Online (www.afterdark.com)
AirMedia Live (www.airmedia.com)
America Online's Driveway (www.aol.com)
Astound WebCast (www.astound.com)
BackWeb (www.backweb.com)
FreeLoader (www.freeloder.com)
IBM NewsTicker (www.infomarket.ibm.com)
inCommon's Downtown (www.incommon.com)
Intermind Communicator (www.intermind.com)
MSNBC News Offline (www.msnbc.com)
My Yahoo!'s News Ticker (my.yahoo.com)
NETdelivery (www.netdelivery.com)
The PointCast Network (www.pointcast.com)

SERVER-SIDE ONLY²

DataChannel's ChannelManager¹
(www.datachannel.com)
Verity's IntelliServ¹ (www.verity.com)
Diffusion's IntraExpress (www.diffusion.com)
Digital Bindery (www.bindery.com)
Excite's NewsTracker (nt.excite.com)
Mercury Mail (www.merc.com)
Netscape's In-Box Direct (www.netscape.com)

CLIENT RECEIVER SOFTWARE³

Lanacom HeadLiner (www.lanacom.com)
Microsoft Active Desktop/Internet Explorer 4.0 (www.microsoft.com)¹
Netscape Netcaster (www.netscape.com)¹

(1) This product was not available at press time. (2) Each of these products or services uses a Web browser or e-mail client as the content receiver.
(3) Each of these products uses a Web server as the content source.

THE PUSH DESKTOP: COMING SOON

By Richard V. Dragan

The battle between Microsoft and Netscape for control of the Web browser is spilling over into a struggle to control your entire desktop. Push technologies promise to be a big part of future versions of Microsoft Internet Explorer and Netscape Communicator, changing the way you receive and use information from the Internet. Once push becomes integrated with Web browsers, push delivery will rapidly become a common part of your information-gathering experience. But don't expect the Web browser to wither away; on the contrary, push delivery will complement the browser to give you a richer, more customizable tool.

The new push desktops borrow their ideas from existing push products, combining the features into a single client. Eventually Microsoft and Netscape clients will replace or subsume today's proprietary push clients. In fact, the final version of Internet Explorer 4.0 should include the ability to connect to PointCast channels (among others). Netscape plans for a future version of Netscape Communicator, called Netcaster, to include Marimba's Castanet Tuner. But in the near term the client portions of products such as BackWeb, Castanet, and PointCast will provide features beyond the basic push included with the browsers.

The two major players are approaching push technology differently. Microsoft is planning to bring its popular Windows desktop to the Web, embedding pieces of the Web browser throughout the operating system and user interface. Netscape Netcaster (formerly code-named Constellation), scheduled to be available by midyear, brings the desktop into its Web interface. The Netcaster desktop will let you access Web sites and e-mail and perform other Internet tasks, but it will also provide an interface to applications and files on your hard disk.

Just like the push clients today, the Microsoft and Netscape desktops will deliver *channels*, information that's packaged in logical groupings. The notion of channels is also referred to as *metacontent*, or information about information. Channel content is often just a headline or a summary that points to a complete version of the article. In an ever-growing Web, channels provide ways to absorb information quickly and pinpoint useful content.

An idea related to channels is *notification*. A smart Internet client will not only tell you when pages on your favorite Web site have changed, it will download the

changed content automatically so you can read it even when you're disconnected from the network. This feature, long a mainstay of off-line browsers, will be in the future Web desktops.

A problem with the Web today is its relatively static content and inherent statelessness (that is, its inability to maintain a client-to-server session). Users want more active, interesting content, and several technologies are ready to deliver this option. Besides traditional HTML, there is *dynamic HTML*, which can update the content on a page with a live feed, so to speak, to multimedia and back-end databases. Java applets and ActiveX controls can also provide the answer here with the ability to interact intelligently with server resources.

Though push and active content are big changes to the Web browser, they're just part of the puzzle. The universe of the Web and your PC's file system are about to be merged. Both Microsoft and Netscape are bringing the intuitiveness of the Web browser into powerful interfaces for interacting with everything on your computer. Push technology adds a new twist, because as the Web is becoming a natural extension of the desktop, it's also getting a more active personality.

INTERNET EXPLORER 4.0

The final version of Microsoft Internet Explorer 4.0—scheduled for release by the time you read this—will include a good deal of push technology. IE 4.0 is the key part of Microsoft's Active Desktop, the company's strategy for its next-generation user interface. Though the product was still in preparation at this writing, Microsoft is clearly committed to the push concept for its users.

The most powerful push technology in Internet Explorer 4.0 is its adoption of channels. We weren't able to get any firm details of what the Internet Explorer channel interface would look like, but you can expect it to be similar to PointCast's two-pane window with channel listings above a content-display pane. Webmasters can build Microsoft-compatible channels using ActiveX, dynamic HTML, HTML, and Java.

Microsoft has also drafted the Channel Definition Format (CDF), a proposed standard for defining push content and how users receive it. (See the sidebar "Microsoft's Channel Definition Format.") CDF files are text files that describe what content is in a channel, what's changed, and when the client should check for updated



information. CDF depends on content that already exists on a Web server; the channel file includes URL pointers that tell a CDF client where to check for newly published information. Though a channel defines a suggested interval to check for updates (say, every hour or every day), a CDF client could proactively check the channel at any user-defined increment. Technically speaking, this is a pull rather than a push process. The client goes to the server to request any updates, but for the end user the experience is the same: Content comes to you instead of you going to it. CDF facilitates an easy, standard way for Web sites—whether on an internal corporate network or on the Internet—to broadcast information to users. Several companies have lined up behind the CDF file specification, including America Online, BackWeb, CompuServe, FreeLoader, NETdelivery, and PointCast.

The other push technology in Internet Explorer 4.0 is the notion of *subscriptions* to Web sites. (Don't worry, these subscriptions are all free.) With subscriptions, Web sites send IE users content automatically. IE can download subscribed Web-site data unattended, and the browser will notify you when new content becomes available via an icon on the Favorites menu next to pages that have changed. You will also have control over how often a subscription is updated. Alternatively, you can choose to have Internet Explorer notify you of Web site changes via e-mail using Outlook Express, IE's new integrated mail and news client.

SUMMARY OF FEATURES

Push Desktops

Microsoft and Netscape plan to include these features in future versions of their Internet clients. All responses are based on vendor-provided information; the actual features might be different.

■ YES ■ NO

Products listed in alphabetical order

General Features

Operating systems supported

Microsoft Windows 3.x/95/NT Workstation 4.0

Mac OS, OS/2 Warp, Unix

Browser integrated into operating system

Browser designed to be a desktop interface

Integrated e-mail/news client

Includes push client receiver

Off-line Web page replication agents

Notifies user of changed Web pages

Includes Marimba's Castanet Tuner

Push Content

HTML/Dynamic HTML

Java applets/JavaScript

ActiveX controls

Microsoft Channel Definition Format (CDF) support

Microsoft
Internet
Explorer 4.0

Netscape
Netcaster

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NETSCAPE NETCASTER

The Netscape browser-and-desktop, Netcaster, will also gain push technology in a variety of forms. Netscape's vision for Netcaster is to make it primarily a communications client—it will be built around the existing Communicator e-mail, news, and Web client—that can retrieve and display content in a variety of ways. Netscape does not believe a standard for push—such as CDF—is necessary, however, and the company has no plans to incorporate support for CDF into its products.

Netcaster will be able to notify you about changed content on your favorite Web sites. When a site changes, you will see a message about it on your desktop (or Homeport, in Netscape's terminology). A notification engine will be built into Netcaster to handle these real-time messages and to display them to the user.

Push content will manifest itself in Netscape Netcaster in several other ways. *LiveSites* are the Netscape equivalent of channels, in which customized content is delivered to users automatically. Web broadcasting the Netscape way works with dynamic HTML, HTML, Java, and JavaScript through standard HTTP servers. A Netscape LiveSite is much like an existing Web site, but it has content marked for broadcast. Netscape has also partnered with Marimba and plans to include the Castanet Tuner in Netcaster.

In addition to LiveSites, Netscape Netcaster will have something called *InfoStream*, which will be an area of the desktop that can deliver small blocks of information in real time. These small pages, or pagelets, will also be able to display pushed content.

OTHER PUSH DESKTOPS

Microsoft and Netscape are not the only players for the future of push desktops. Sun Microsystems' HotJava Views is a desktop (Sun calls it a "webtop") for its JavaStation terminals that will have push-enabled features along with its core e-mail, calendaring, and Web access tools. Basically, JavaStation administrators can define a profile of what software and content users would be interested in and have it pushed to their desktops. The JavaStation architecture stores users' computing desktop parameters on a server, so that your desktop is available from any machine. Network Computer Inc., a subsidiary of Oracle Corp., has similar plans to include a news ticker and other push technology into its thin-client desktop environment.

In whatever guise it takes, push technology will certainly have an impact your Web browser and your desktop, and all indications are that it will enhance your computing experience. Desktops of the future will become more Web-centered, and their approaches to getting the information you want will change, too.

* For Windows 3.x and Mac OS, Internet Explorer 4.0 may not be integrated with the operating system



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THE NEW WEB-TUNED LOTUS 1-2-3® 97 HAS ARRIVED ▶ WHY JUST CRUNCH NUMBERS WHEN YOU CAN **CRUNCH** COMPETITORS?

INTRODUCING LOTUS SMARTSUITE® 97 WITH THE NEW 1-2-3® 97. The Web is not a toy. With SmartSuite 97, it can be a serious competitive advantage. Now, from inside any Lotus 1-2-3 spreadsheet, you can grab the most current market data for your sales forecast — red-hot off the Web. Then publish the forecast directly to a Lotus Notes® database and onto your company intranet. So, in this ruthlessly competitive world, you and your coworkers can be armed with up-to-the-second information that can help you do your jobs more effectively.

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SmartSuite 97 also makes it easy to stay organized as you stay up-to-date. The Lotus SmartCenter™ lets you create a set of personalized drawers for applications, files and every source of information. (The SmartCenter Internet drawer provides live Web access to news and more.) It's all about getting more stuff done and staying ahead of the competition. If not crunching them entirely. SmartSuite is included with IBM® Aptiva®, ThinkPad® and PC desktops, as well as AST® Advantage PCs. For your free SmartSuite 97 trial CD, call us at 1-800-TRADE-UP, ext. C885, or visit www.lotus.com/smartsuite.

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vide a simple Java design tool, Bongo, and also has support from several third-party Java developers. Version 2.0 of Castanet, due out in beta later this year, will add support for distributing non-Java applications.

At the present, Castanet channels are able to distribute Java applications and HTML pages. In some future release, Marimba plans to allow you to transfer other types of binary files. But maintaining the same level of security provided by Java applications is a major hurdle. Castanet benefits from the Java security models, which allow a channel to read and write only from a directory created for it on the hard disk. For Windows applications, that level of security doesn't exist today. Theoretically, a Windows executable is free to do whatever it pleases to your system.

The real innovation of Castanet, and

the reason that Castanet is better than traditional software distribution methods, lies in its intelligent methods of updating the channels it broadcasts. All files are sent using a single TCP connection, and only modified parts of files are sent across the network. Channels that share Java code can also share updates, so that if several channels need a new version of a certain Java class, the Tuner downloads it only once.

Castanet channels can also distribute HTML pages. In fact, you can create a channel that contains an entire Web site so users can keep a copy locally and browse off-line. It's not a bad way to distribute product documentation or company data that is automatically updated; given the cost and maintenance required, though, Castanet's not ideal for just distributing files.

Castanet Transmitters, the server portion of Castanet, run on Microsoft Windows 95, Windows NT, and Sun Solaris—delivering channels to Tuners all over the Internet or your company's intranet. The Castanet Tuner client software runs on Windows 95, Windows NT, and Solaris systems, with a Macintosh client in beta. So although Java programs are platform-independent, the current version of Castanet doesn't support every client platform, including Windows 3.x, OS/2, and other Unix flavors. But Marimba has announced agreements with several vendors to incorporate Castanet into their products, including future versions of Netscape Navigator and the Mac OS.

Setting up the software, either Transmitter or Tuner, is very simple. All you need to do is specify an installation directory and some simple configuration data.

INTRAEXPRESS: PUSHING BEYOND THE NETWORK

By Eric Harper

Unlike the push servers in our main roundup, Diffusion's IntraExpress broadcasts information to any user you specify, whether or not they are even connected to a network. IntraExpress lets you distribute existing documents in multiple ways: You can post it on a Web site, send it as an e-mail message, fax it to any number you wish, print it out on a network printer, or transmit it to someone's pager. You can also set up IntraExpress to use another push server as one of your publishing options. Diffusion can even arrange for a service to let you send messages via the U.S. Postal Service.

All this flexibility comes at a steep price, however. The IntraExpress Starter Kit is priced beginning at \$35,000 (list), which includes server software, client software for 100 recipients and 5 senders; maintenance and support for one year, and three days of on-site consulting. Each additional recipient and sender is \$125 per user.

IntraExpress comes in three parts: server software, sender software, and recipient software. The server software runs as a service on Microsoft Windows NT Server 3.51 and later. It uses

TCP/IP, HTTP, and e-mail protocols to communicate with senders and recipients. IntraExpress supports SMTP- and MAPI-compliant mail systems. If you want to use the Web-publishing features, you need to run a Web server (such as Microsoft Internet Information Server, included with Windows NT 4.0). The sender application, called Distribu-



IntraExpress lets you administer distribution templates and user profiles.

tion Manager, runs on Windows 95 and Windows NT Workstation 4.0.

To send out information using IntraExpress, you set up an Information-Distribution Template, which includes the properties of a particular distribution. For example, you can associate a distribution list with a particular report.

Every time you send the report, IntraExpress keeps track of recipients and how they prefer to get information.

Recipients, too, have flexibility in controlling the flow of data. They can choose to have information delivered on an ongoing basis, to be notified when information is made available, or to decline a subscription to specific information. Recipients can decide to set aside information for future reference.

IntraExpress stores all distributions in a reference library that is accessible from the recipient software. You can also export the library to a Web server. Recipients can change their distribution profiles using either IntraExpress' recipient software or a Java-enabled Web browser such as Microsoft Internet Explorer or Netscape Navigator.

If you need to send documents to many people who require different delivery methods, IntraExpress is worth considering. Though pricey, IntraExpress provides a flexible document-delivery alternative to the other push servers we reviewed.

IntraExpress. List price: \$35,000 and up. Diffusion Inc., Mountain View, CA; 415-237-8500; www.diffusion.com. Circle 451 on reader service card.

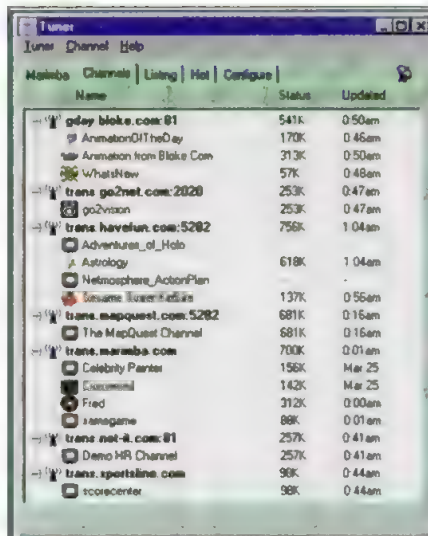
NETWORKING

Push Servers

You can even set up a Transmitter and a Tuner on the same computer to test your channels before you publish them. When a user subscribes to a channel, the Castanet Tuner downloads the application and launches it all in one step. Users can update the channel in the Tuner manually. Alternatively, the author of the channel can specify when to check for updates.

In addition to the Transmitter software, servers can also run Castanet Proxies and Castanet Repeaters (both of which were in beta at the time of our testing). Castanet Proxies will periodically check the original servers to make sure channels are up to date. Castanet Repeaters will mirror channels across multiple Transmitters. But unlike mirrored Web or FTP sites, a Repeater automatically checks to ensure the latest updates. Repeaters can also perform load-balancing to redirect client requests to a Transmitter that's less busy or geographically closer to the client.

To help you create Castanet channels with Java applets, Marimba separately sells a tool called Bongo (\$495), a Java-interface creation tool. It's not required



Castanet Tuner lets you subscribe to channels from any number of different Transmitters.

for distributing Castanet channels, but it does provide an application builder you'll find fairly easy to use but not extremely powerful. For building more full-featured Java applications, developers will want to use third-party products such as Syman-

tec's Visual Café. You can use Bongo to build the Castanet interface, then integrate it with your Java integrated development environment (IDE).

Marimba's Castanet is the most innovative of all the products reviewed here. It has great potential because it's designed so well. The ease with which you can distribute programs and the intelligent way Castanet updates them are impressive. But for now, the product's appeal is limited to networks running Java-based programs.—*Eric Harper*

Castanet. List price: \$1,000 for 100 Tuners per hour; \$25,000 for unlimited use. Marimba Inc., Palo Alto, CA; 415-328-5282; www.marimba.com. **Circle 448 on reader service card.**

Wayfarer Communications Inc.

Incisa

Wayfarer Communications' Incisa is a corporate data broadcasting tool that allows managers to send carefully filtered news, messages, and Internet URLs to Incisa users' desktops. We liked

The executive can run all of his stuff with 16MB memory standard.

The fast thinker churns through work with a 150 MHz¹ Pentium[®] processor.

The multitasker likes the integrated hard disk, floppy and CD² built in.

The deep thinker has a 2.1GB³ hard disk to file away every brainstorm.

ThinkPad

intel inside pentium

THINK delivers internal clock speed of the microprocessor (only when the processor is in the "Turbo" mode). 1. Intel Inside Pentium processor. 2. CD-ROM drive. 3. Hard disk. 4. RAM. 5. Hard disk. 6. Hard disk. 7. Hard disk. 8. Hard disk. 9. Hard disk. 10. Hard disk. 11. Hard disk. 12. Hard disk. 13. Hard disk. 14. Hard disk. 15. Hard disk. 16. Hard disk. 17. Hard disk. 18. Hard disk. 19. Hard disk. 20. Hard disk. 21. Hard disk. 22. Hard disk. 23. Hard disk. 24. Hard disk. 25. Hard disk. 26. Hard disk. 27. Hard disk. 28. Hard disk. 29. Hard disk. 30. Hard disk. 31. Hard disk. 32. Hard disk. 33. Hard disk. 34. Hard disk. 35. Hard disk. 36. Hard disk. 37. Hard disk. 38. Hard disk. 39. Hard disk. 40. Hard disk. 41. Hard disk. 42. Hard disk. 43. Hard disk. 44. Hard disk. 45. Hard disk. 46. Hard disk. 47. Hard disk. 48. Hard disk. 49. Hard disk. 50. Hard disk. 51. Hard disk. 52. Hard disk. 53. Hard disk. 54. Hard disk. 55. Hard disk. 56. Hard disk. 57. Hard disk. 58. Hard disk. 59. 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NETWORKING

Push Servers

the product's content management features. But like BackWeb and PointCast, aside from Wayfarer's news feed we didn't find anything extraordinary in Incisa that companies don't already get through an e-mail system. Also, Incisa's lack of a channel metaphor limits its usefulness on the client compared with other push servers.

At first glance, Incisa (\$5,000 to \$25,000 list, plus annual fees) appears to be very similar to PointCast. Both products display news, stock quotes, and other information on users' screens. But while PointCast is an advertising-supported service aimed at the general public, Incisa targets the corporate workplace. Unlike PointCast, Incisa's news and stock feeds don't contain advertising, and Incisa provides sophisticated data filtering tools for control over what each user sees.

The Incisa server runs on Sun Solaris or Windows NT; we tested the Windows NT version. The Incisa client runs on Windows 3.x, Windows 95, and Windows NT. Both the client and the server are very easy to install. We had our server up and running in about 30 minutes, including the time it

took to create several test messages. The server hosts all locally generated data and acts as a proxy server for the news feed data from Wayfarer's Internet site.

Like BackWeb, the Incisa server has a minimal management interface. Management chores are performed with the Incisa Reporter program, which runs on any network PC. Using Reporter, an administrator tells the server what data to collect and which Incisa groups are to receive it. Reporter contains a very thorough suite of data-filtering tools which allow you to route specific types of information to specific groups of Incisa users. For example, you may allow your management users to see the Reuters business news feed while restricting other users to seeing only internally generated information.

The Incisa client is a small, movable (but not resizable) window that continuously displays incoming Incisa messages called HeadLinks. Unlike all the other products we reviewed, Incisa doesn't really have a concept of separate channels on the client. Each HeadLink appears for a few seconds in the main window; then the next one

takes its place. If you miss one, you can scroll through a list of recent HeadLinks to find messages of interest, but the interface is not as easy to navigate as BackWeb's or PointCast's. HeadLinks are delivered as Shockwave animations, and Wayfarer provides several preconfigured Shockwave scripts for creating your own HeadLinks. (If you want to develop your own Shockwave animations, you must purchase Macromedia Director.) Each HeadLink contains a heading, a few lines of text, and an optional URL.

HeadLinks with more than a few lines display with a scroll bar in the tiny Incisa window to let users read the entire message. We quickly found that items more than a few lines long are best left on a Web server. The HeadLink would contain just the URL to point the user to the full article.

Users can choose to have the Incisa client remain on top at all times, but we found that the client's constantly changing screen was distracting.

The Incisa server automatically creates HeadLinks for each news item received from the news feed. Creating your own

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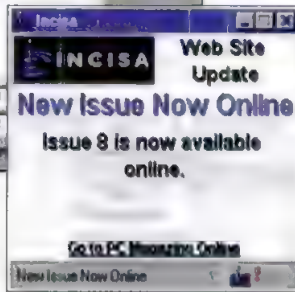


COMPUERVE.
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NETWORKING

Push Servers

To send an Incisa broadcast, you type text in the message form and click OK...



...and it appears on the client screens of the Incisa users you've selected.

HeadLinks is a simple process: In the Reporter program you select which animation to use; type in a heading, a few lines of text, and an optional URL; and then select the Incisa group or groups to receive the message. Your new HeadLink is placed in the outgoing mes-

sage queue along with additional HeadLinks from the news feed. If you check the Urgent option, Incisa places that HeadLink at the top of the list to be seen by the client.

Incisa can import live data from several sources, including Microsoft Access, Microsoft SQL Server, and Oracle databases. The Incisa DataBridge provides an ODBC connection to these databases and can automatically create HeadLinks on the fly based on new information, but you'll need to write the data-extraction code yourself using a development language such as C++.

Unique among the products we reviewed, Incisa uses a persistent connection between the server and clients. Every other push server we reviewed technically uses a client-polling technique in which the client software periodically checks for updates on the server. Incisa's Quick-Server technology allows for faster delivery of HeadLinks, since the client doesn't have to reestablish a connection with the server each time it receives a HeadLink. Also, the

server needs to send a HeadLink just once over the network, instead of delivering it every time individual clients request it.

Incisa is also the only product in our roundup to provide encryption. An RSA encryption option is available for \$1,000 to \$10,000, depending on the number of users. The package provides secure communications with work-at-home users, business partners, and other Incisa users who are outside of your network firewall.—LF

Incisa. List price: \$5,000 to \$25,000; annual fee, \$3,300 to \$14,100. Wayfarer Communications Inc., Mountain View, CA; 800-300-8559; www.wayfarer.com. Circle number 449 on reader service card.

PointCast Inc.

PointCast I-Server

PointCast, the founding father of push, has a server to please corporate aficionados of its popular Internet client service. The I-Server and its administration tools put HTML-based information broadcasting capabilities firmly in the hands of the network administrator. But Internet



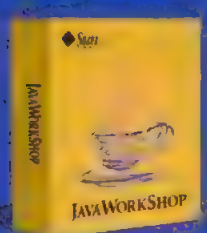
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PC Magazine, Jan. 7, 1997
Best of Year Award

"...extremely flexible and surprisingly easy to configure..."



Network Computing, Sept. 15, 1996
Editor's Choice Award

"...easy installation, superior management features, and good performance..."



PC Magazine, Nov. 19, 1996
Editors' Choice Award



Government Computer News, 1997
Best New Product Award

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content is still king for PointCast: I-Server 1.2 can deliver only HTML pages and links today compared with Castanet's Java applications and BackWeb's multiple file formats. I-Server doesn't allow network administrators to shut off channels or their associated advertising, and the product does not include any development tools. For a company that values PointCast's information feed for its employees, though, I-Server is worth serious consideration.

The I-Server (\$995 list per server CPU) acts as the conduit between the PointCast clients on your internal network and the Internet-based PointCast Network. Information channels feed to the server, which then sends the content to the requesting clients. The I-Server, which runs on Windows NT Server, is simple to install and includes intuitive Java-based content-creation and management utilities. (PointCast has announced plans for an HP-UX version of I-Server.) To receive PointCast's news and information feeds, the I-Server requires an Internet connection. Unlike the other push servers reviewed here, PointCast includes advertising with its con-

MICROSOFT'S CHANNEL DEFINITION FORMAT

By Todd Spangler

The push concept has picked up so much momentum that Microsoft has proposed a standard format for push content channels. Microsoft's Channel Definition Format (CDF) is a simple, text-based format for letting publishers define channels that point to Web pages.

The preliminary CDF specification has three main components: the channel itself, items, and schedules. The text-based CDF file structure is based on a subset of Standard Generalized Markup Language (SGML). You can find a complete description of the CDF proposal at www.microsoft.com/standards/cdf.htm. To set up a CDF-based channel, a Web publisher would just need to create the .CDF file that defines which Web pages are part of the

channel. Web clients download the file via HTTP.

Microsoft plans to include CDF support in its soon-to-be-released Internet Explorer 4.0. Other vendors, including BackWeb and PointCast, have plans to support CDF channels in their own clients. Conspicuously, Netscape has said it will not support CDF and that it doesn't believe such a standard is necessary.

CDF doesn't break new technological ground; it just provides a standard way to use channels. All of the push vendors currently have some method of defining, delivering, and displaying channels. CDF defines only a simple framework for push content delivery, so companies like BackWeb and PointCast might still keep some proprietary functionality in their clients.

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OTHER PRODUCTS IN THE PIPELINE

By Todd Spangler

In addition to the products in our main roundup, there are several other push server systems designed to be used on internal corporate networks that weren't available for us to take a look at.

MINDING THE DATABASE

Like BackWeb, PointCast, and other push vendors, Intermind is straddling the fence as both an Internet content service and an intranet-oriented product. The company's flagship product is Intermind Communicator, a push system that uses a technique similar to Microsoft's recently proposed Channel Definition Format (CDF), although Intermind had the idea first. (For more on CDF, see the sidebar "Microsoft's Channel Definition Format.") The product is free to download for Internet users, but to use it on a company intranet or commercial Web site you must purchase a license; contact Intermind for pricing information.

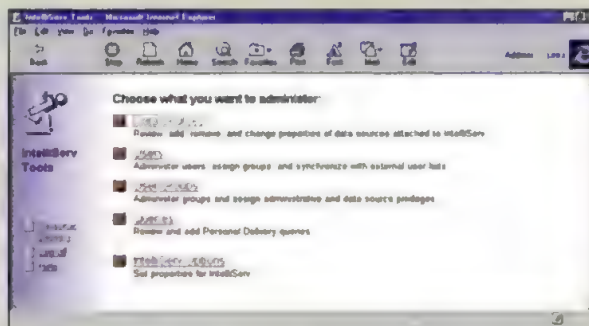
An Intermind Channel points to an existing Web site and can send Intermind users either summary information and a URL, or an entire HTML page. Though it's easy to create a channel using Intermind's well-designed HTML interface, it can be time-consuming. Intermind's Dynamic Publisher takes the manual labor out of creating Intermind channels. Available for Windows 95, Windows NT, and Sun Solaris, Dynamic Publisher automatically creates new Intermind channel information based on changes in a database.

Intermind recently announced plans to work with U.K.-based New Information Paradigms to develop an application called Dynamic Publisher for Domino, which will work with Lotus Domino. Broadcast to notify users automatically via Intermind of changes in Domino databases. Another Dynamic Publisher product in development is based on Simware's Salvo mainframe and database connectivity middleware.

Dynamic Publisher. List price: \$12,000. Intermind Corp., Seattle; 206-812-6000; www.intermind.com. *Circle 452 on reader service card.*

SORTING UNSTRUCTURED DATA

Verity is busily incorporating its search engine technology into an entire line of products called Search'97. One of the newest of these is IntelliServ, a push application for Windows NT Server scheduled for release by the time you read this.



Verity's IntelliServ will provide a Web-based administration interface for managing users, data sources, and other parameters.

IntelliServ monitors multiple data sources to find documents that match search terms entered by individual users. In the first release, it will be able to check Web sites, ODBC-compliant databases, POP3 mail, and stored Verity searches. The system doesn't require any proprietary client software: You receive all your information through a standard Web browser, or you can choose to have new information sent via e-mail or pager. IntelliServ uses Microsoft's Active Server Page (ASP) technology to push updated information to your search page as it locates it.

Administrators can assign rights to groups and users for various data sources. The system also allows flexibility in defining data sources—letting an administrator or a user with proper rights specify how many levels deep to search a Web site, for example. (Setting IntelliServ to search two levels would result in an index of the main page and all pages linked from it.) IntelliServ will

ship with a software development kit (SDK) so programmers can integrate it with other applications.

IntelliServ. List price: Not yet announced. Verity Inc., Sunnyvale, CA; 408-541-1500; www.verity.com. *Circle 453 on reader service card.*

UNIFIED INFORMATION CLIENT

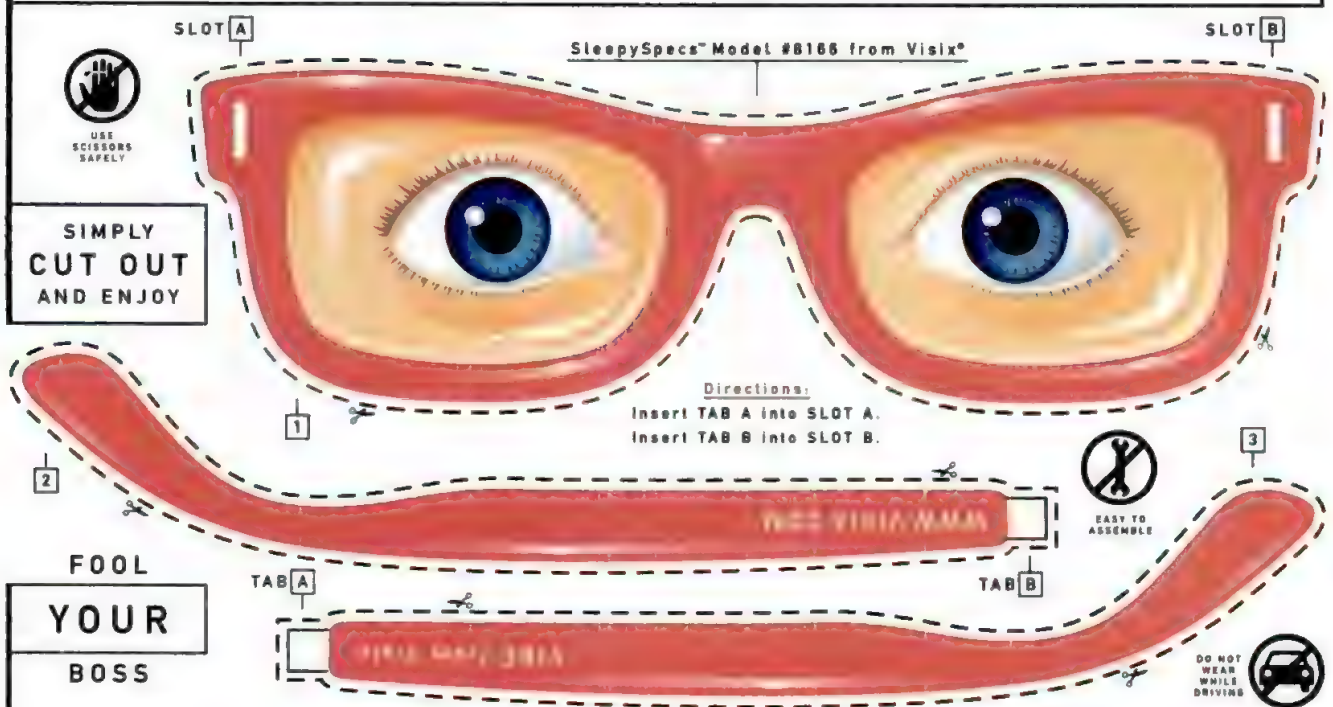
Like IntelliServ, DataChannel's ChannelManager is designed to replace users' separate information-gathering applications. ChannelManager, a server-based product for Microsoft Windows NT Server and Sun Solaris, is due to ship by midyear and will be priced between \$20 and \$60 per user depending on quantity. ChannelManager users will require only a Java-enabled browser.

Using ChannelManager tools, an administrator would set up an HTML and Java interface for a user (or group of users) to access multiple data sources. This Web-based interface might be able to access any sort of data, whether from corporate databases, Web servers, or external news feeds.

The ChannelManager server, which requires a separate Web server, will notify users of new content via a Java applet client running in the users' Web browsers. Templates will allow an administrator to control the layout of browser interfaces. When ChannelManager ships, DataChannel says that it will include support for LDAP directories and ODBC database connectivity. DataChannel also plans to incorporate multicasting technology from TIBCO into the ChannelManager architecture.

ChannelManager. List price: \$20 to \$60 per user. DataChannel Inc., Bellevue, WA; 206-462-1999; www.datachannel.com. *Circle 454 on reader service card.*

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GROUPWARE AS PUSH SERVERS

By Tony Pompili

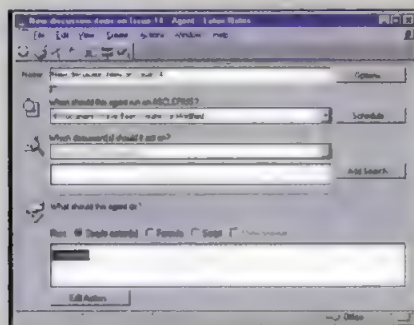
If you're considering push software but you're not excited about adding yet another application to your network, look again at your existing groupware system. Though collaboration is certainly a central theme of products such as Domino, Exchange, and Novell's GroupWise, those products also include many push features for distributing information throughout your organization. (For a roundup of groupware packages, see "Multiple Personalities," *PC Magazine*, May 27, 1997.)

At the most basic level, groupware lets users broadcast information to groups via e-mail. Furthermore, users can act on received information directly in the groupware client. A groupware workflow application, for example, can include intelligent information-routing and approval rules. This differs from most standalone push software products, which are designed as one-way broadcast media.

Lotus, for one, is aggressively extending Domino to work with other push technologies. Lotus has announced Domino.Broadcast, which will be able to publish Domino database information using a variety of push

servers including those from BackWeb, Marimba, PointCast, and Wayfarer.

From their inception, groupware products have had the ability to collect information in databases and data stores. Exchange and Lotus Domino let you store documents and other information in databases and provide application programming interfaces



Lotus Notes lets you set up agents to notify you when information is added to a database.

(APIs) to allow developers to manipulate data in the store.

This access allows a variety of data-driven applications. For example, Individual's Hoover is a news-feed service that takes news-wire stories and converts them into individual documents in a Domino database. Lotus Notes users can access the feeds

directly from the database.

Like push software, groupware can analyze and distribute information to individual users. Domino lets you create powerful agents that can periodically check a collection of documents and perform actions based on what they find. Similarly, Exchange and GroupWise use rules to perform similar kinds of tasks. Agents or rules allow you to glean information from a variety of sources based on a set of criteria, such as a company name or news source.

Most groupware products offer features beyond simply forwarding documents from a database. Exchange, for example, lets you send an e-mail with just a link to the actual data. Domino takes this a step further with its newsletter feature, which periodically generates a single message with multiple links instead of dozens of individual messages.

The extensive development features of groupware let you integrate push functionality in all kinds of applications. Though they lack the out-of-the-box features of push servers, groupware packages can allow you to create your own push system without having to maintain separate push clients and servers.

tent. With the current version of I-Server, you can't disable channels or advertising to prevent users from seeing them. PointCast is considering future versions of I-Server that would allow blocking of channels.

When used without the I-Server, PointCast can use considerable bandwidth of companies' Internet connections. The I-Server's caching capability entirely eliminates requests for the same information by multiple clients, reducing Internet-bound traffic. The server will not reduce internal LAN traffic, but most sites will find that traffic generated by PointCast clients accessing an I-Server has a minor effect on network capacity.

A network administrator with existing PointCast users can automatically assign them to the company's internal I-Server. When you register the server with Point-

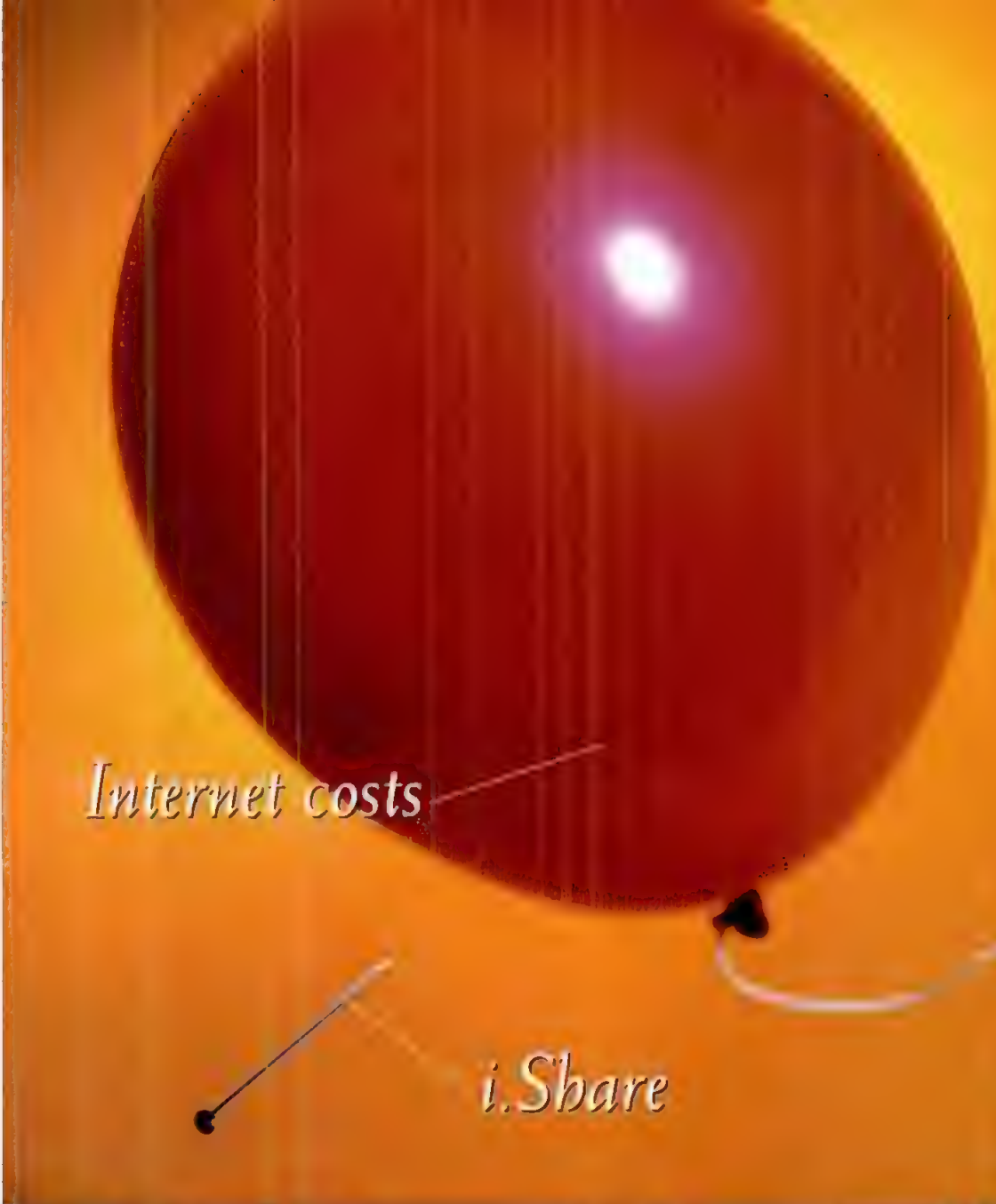
Cast's Central Broadcast Facility, the browser-based Redirection utility lets you easily define which client IP addresses should use your I-Server. PointCast's broadcast center then redirects clients to your local I-Server. If you prefer, you can modify each client's configuration file manually to connect them instantly to the internal I-Server.

The PointCast client software is available for Windows 3.x and Windows 95 (but currently not for Windows NT), and a Macintosh version is in beta. It can display the HTML channel content in a screen saver, in a scrolling ticker, or in its main viewer panel. A channel selector on the left-hand side is similar to BackWeb's and is just as easy to navigate. The PointCast client includes a built-in Web browser. Like other so-called push systems we

reviewed (except for Incisa), PointCast in fact uses a client-polling method for updates at user-configurable intervals.

Besides the variety of commercial news services provided through PointCast—which include CNN, *The New York Times*, and Reuters—the I-Server includes an important addition: the Corporate Channel, which lets you send your own HTML content over PointCast. You can name your one channel anything you want and associate a corporate logo for it. The channel then appears on PointCast clients as the last channel on the selector.

Administrators can create any number of subchannels of the Corporate Channel to organize content. Typical subchannels may include human resources, sales, or any subject that applies to your organization. Within each subchannel, you add the article



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SUMMARY OF FEATURES

Push Servers

■ YES ■ NO □ OPTIONAL

Products listed in alphabetical order

	BackWeb 1.1	Castanet	Incisa	PointCast I-Server 1.2
List price for server	\$10,500 (plus usage license)	\$1,000 (100-user-per-hour license)	\$5,000 (100-user license)	\$995
Protocols used for broadcasting:				
HTTP/UDP	■ ■	■ ■	■ ■	■ ■
Other	None	None	TCP Sockets	None
Number of external channels available	60	150	3	25
Number of custom channels supported	Unlimited	Unlimited	1	1
System can broadcast:				
Audio/Video	■ ■	■ ■	■ ■	■ ■
Binary files/HTML pages/Java applets	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
ActiveX objects/Netscape plug-ins	■ ■	■ ■	■ ■	■ ■
Pop-up messages/Screen saver/Wallpaper	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Scrolling ticker messages/Shockwave files	■ ■	■ ■	■ ■	■ ■
URLs that can launch Web browser	■	■	■	■
Commercial newfeeds	Infospek, ZDNet, others	None	PR Newswire, Reuters	CNN, Reuters, others
Server operating systems supported:				
Microsoft Windows NT 3.51/4.0	■ ■	■ ■	■ ■	■ ■
Solaris 2.4/2.5x	■ ■	■ ■	■ ■	■ ■
NetWare 4.x, OS/2 Warp Server	■ ■	■ ■	■ ■	■ ■
System provides proxy server	■ *	■ *	■	■
Client Software				
Client operating systems supported:				
Microsoft Windows 3.x/95/NT 4.0	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Mac OS, OS/2 Warp	■ *	■ *	■ ■	■ *
New content notification via:				
Pop-up screen	■	■	■	■
Windows system tray icon	■	■	■	■
User can define content delivery method	■	■	■	■
User can set frequency to check for updates	■	■	N/A†	■
User can set maximum data-storage threshold	■	■	■	■
Client provides built-in:				
Java virtual machine (VM)	■	■	■	■
Web browser	■	■	■	■
Administration				
Management via browser/Windows console	■ ■	■ ■	■ ■	■ ■
Administrator can:				
Disable external channels/advertising	■ N/A†	■ N/A†	■ N/A†	■ ■
Set user name and password for channels/subchannels	■ ■	■ ■	■ ■	■ ■
Send broadcasts to users/groups/profiles	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Server provides:				
Content-aging controls	■	■	■	■
Real-time performance monitoring	■	■	■	■
Windows NT Performance Monitor	■	■	■	■
Historical logs and statistics	■	■	■	■
Instant message broadcast	■	■	■	■
Uses differential download for files	■	■	N/A†	N/A†
Security via Java/RSA/proprietary system	■ ■ ■ ■	■ ■ ■ ■	■ □ ■	■ ■ ■ ■
Development and Content Creation				
Development languages supported	None	Java	C++, Java, VB, others	None
Content-creation tool	■ (BALI editor)	□ (Bongo)	□ (Shockwave)	■
Includes software development kit (SDK)	■	■	■	■
Server natively supports:				
CGI/ISAPI/NSAPI	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Open Database Connectivity (ODBC)	■	■	■	■
Java Database Connectivity (JDBC)	■	■	■	■
Microsoft SQL Server/Oracle/Sybase	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■

* This feature was in beta testing at the time of our roundup.
N/A†—Not applicable: The product does not have this feature.

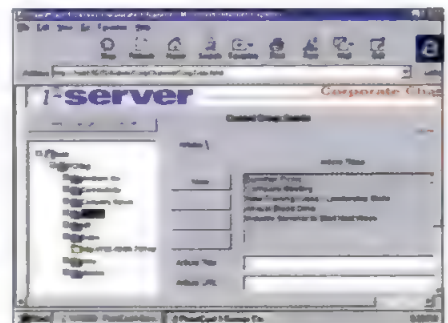
N/A†—Not applicable: The client does not poll for updates.

title and URL for the HTML file. The news-ticker editing interface includes easy add and remove capabilities to indicate which items to include in the ticker, as well as a feature for broadcasting information flashes and headlines in near real time.

PointCast recently announced PointCast Connections, a component of its next version that will allow anyone to publish a PointCast subchannel using Microsoft's proposed Channel Definition Format (CDF). Also, the final release of Microsoft Internet Explorer 4.0 will include the ability to receive PointCast content.

Currently, PointCast has no developer kits or tools available, such as those provided by BackWeb and Marimba, though PointCast plans to remedy this in a future release. The PointCast client viewing template and interface are unalterable. Unlike Wayfarer's Incisa, I-Server doesn't provide tools to access back-end databases. But Domino.Broadcast for PointCast (jointly developed with Lotus) allows delivery of HTML-based Domino content via the PointCast Corporate Channel.

The I-Server's administration tools are



PointCast I-Server's administration tools are accessible through a Web browser.

the most intuitive of any product in this roundup. The management interface is accessible via a Web browser (unique among the products we reviewed) or Windows console, and it lets you remotely track multiple I-Servers. I-Server has extensive built-in transaction and error logging, along with accompanying viewer-analysis tools for summaries or full reports. Information-sorting options let you sort log data by date, host, IP address, or HTTP response code.—Jeffrey G. Witt □

PointCast I-Server 1.2. List price: \$995 per server CPU. PointCast Inc., Cupertino, CA; 408-253-0894; www.pointcast.com. Circle 450 on reader service card.



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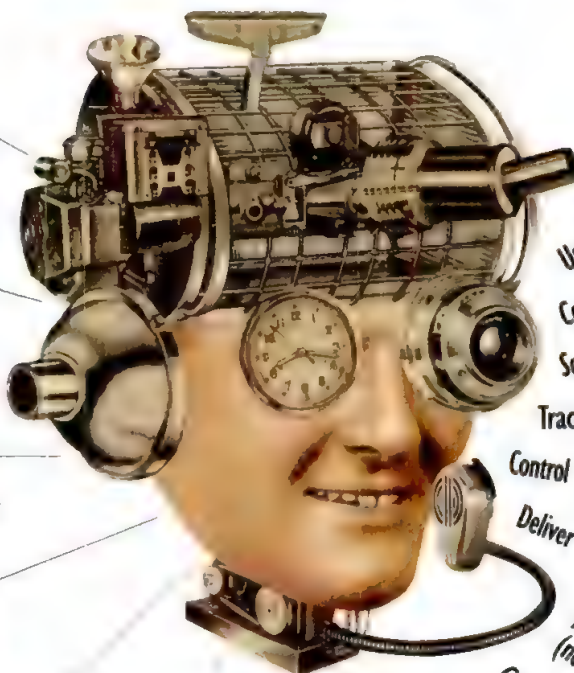
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You're getting hit from all sides to deliver cooler, bigger, more diverse and more personalized content. They want it online tomorrow. It can't be limited to words anymore. And you certainly can't wait for users to come. The answer, of course, is push. But keep in mind, there are things that separate a killer push technology from merely a good push technology.

For example, downloading. BackWeb's Polite Agent™ technology doubles a user's bandwidth because it downloads content incrementally in the background during a user's idle time online.

There's also BackWeb's differential download feature, which updates only the

information that has changed from the last content sent. (Don't try that with just any push technology.)

With BackWeb, you can integrate with backend databases for 1-to-1 personalization. You can target your content to only your desired audience. And thanks to BackWeb, you get smart information and application delivery that lets you target users with specific hardware and plug-ins, and set release and expiration dates on information. All this, plus the ability to track users' interactions and provide feedback.

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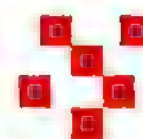
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By James Karney

If you're producing multiple copies of multipage documents, you're probably doing it the old-fashioned way: You first make a clean original print-out, then feed it to the office copier, which quickly reproduces, collates, and staples a dozen copies. But the quality is, to put it mildly, variable—good if the copier repairman was here yesterday, not so good otherwise.

Now laser printers have the speed and the capabilities to supplant the office copier. The latest generation of network printers can offer much more than just clean laser output. Options and computing intelligence let them serve as office copier, mailbox, collator, stapler, and even scanner and fax machine. They handle more text, more graphics, and the Internet's compound documents. In many installations there are a host of



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Lexmark Optra N 245	210
Lexmark Optra S 1250	210
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Additional information and interactive elements can be found in the online version of "Print! Don't Copy."

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A printer that fits

The size of your workgroup is a good starting point for determining how fast a printer you need. To make the most savvy decision (and one you won't regret in a year), you'll also need to take a close look at printing habits around the office.

SMALL WORKGROUP

12 ppm

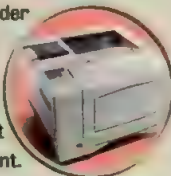
If you are buying for a small workgroup (five users) that prints occasional, short (2-to-10 page) text documents (letters, proposals, reports), a 12-ppm unit should fill the bill. Even at this speed, you can be sure jobs will be finished by the time you make your way down the hall to pick them up. If your office mates are printing a lot of complex spreadsheets and graphics (like Web pages), or if anyone needs tabloid-size (11-by-17) printing, you'll have to look to the next level.



MEDIUM-SIZE WORKGROUP

16 to 20 ppm

Buying for a larger workgroup (6 to 15 users), or for users who frequently print complex, formatted documents (proposals with charts and graphics) or lengthy documents (more than 10 pages), requires a more robust printer in the 16- to 20-ppm class. Look for the features you need, such as tabloid printing, person- or job-specific bins, or lockable private mailboxes. If your organization is growing, consider stepping up to a 24-ppm model if you can, to protect your investment.



DEPARTMENTAL

24 ppm

If you plan on sharing a printer among a whole department (more than 15 users), the volume and varied nature of the print jobs dictate a 24-ppm printer. All the printers we looked at in this class offer tabloid printing for producing large spreadsheets or desktop publishing pages, and the paper-handling options—sorters, staplers, bins galore—mean you can build a machine that nearly obsoletes the office copier while saving users time in the process.



ENTERPRISE-WIDE

40 ppm

For back-office printing, or in environments that need to produce reams of text documents (such as a law office), look at one of the 40-ppm paper pushers on the market. These monsters are designed for printing high volume (300,000 pages per month) at low cost (less than a penny per page). Don't expect them to produce fancy graphics; their generally lower resolutions are designed to print text. Huge input trays mean you can load a forest in before refilling.



printer languages, network protocols, and operating environments to contend with, not to mention varied user needs and budget constraints. Given the five-year life span of most printers, adding a new one today requires considering your present and future needs and long-term networking plan to get the most from your investment.

REVIEW CRITERIA

For this review PC Labs tested the current crop of 12- to 40-page-per-minute laser printers designed for shared use over a local area network. We included only monochrome (black-and-white) lasers here; we'll review shared color printers later in the year. To be eligible for inclusion, a printer had to offer NetWare connectivity (and preferably Windows NT support as well), come equipped with at least PCL 5 or PostScript Level 2 page description language (PDL) support, and be new to the market since our roundup last year ("Share and Share a Lot," June 11, 1996). We invited two previous Editors' Choice winners that are still on the market back to see how they compared against the newcomers.

We found 22 printers from 12 manu-

facturers that fit our criteria, falling roughly into four categories:

- 7 small-workgroup units (12 pages per minute);
- 7 medium-size-workgroup units (16 to 20 ppm);
- 5 departmental printers (24 ppm);
- 3 enterprise systems (40 ppm).

New printers from Dataproducts, Epson, Lexmark, Minolta, NEC, and Xerox were not ready in time for this roundup.

The 12-ppm class is generally aimed at workgroups of up to five users producing mostly simple text documents. The printers sell for \$1,500 to \$2,500 including the network interface card (which is optional in this class), plus PostScript, if you want it.

Paper handling also tends to be less robust than you'll get with a faster, more expensive unit. You'll need to pay extra for large-capacity input trays (standard input capacity is usually 350 to 500 sheets) and

duplexers for automatic printing on both sides of a sheet (which cuts your paper cost in half). Two 12-ppm printers do include duplexing as a standard feature: the Apple LaserWriter 12/640 PS Plus (\$2,200 street), which comes with 830 sheets of total input capacity, and the Xerox DocuPrint 4512 (\$1,270 street). If your network needs are modest—and will stay that way—an entry-level device will do the job.

More robust in terms of both speed and features are the 16- to 20-ppm models aimed at medium-size workgroups (6 to 15 users) or at smaller groups that tend to print more graphics-intensive documents (complex spreadsheets, reports, presentations). A decently configured midrange unit, including an optional duplexer, will typically cost from \$2,000 to \$2,700. The only tabloid-capable unit (able to print on 11-by-17 paper) in this class that we tested, the 20-ppm QMS 2060 EX, lists for \$5,999. Standard paper capacity ranges from a low

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Editors' Choice

- *Small workgroup:* Lexmark Optra S 1250
- *Medium-size workgroup:* Lexmark Optra S 1650
- *Department:* Lexmark Optra N 245, QMS 2425 EX



We uncovered several good choices in each class—and one or two standouts. If you are buying a printer for a small workgroup of five users or so, you'll want to consider the Lexmark Optra S 1250, our Editors' Choice. The 12-ppm Optra S 1250 (\$1,140 street, not

including the Ethernet adapter—\$499 list) was the fastest in its group. Its 600-dpi print quality was superb, and users can upgrade to an outstanding 1,200 dpi should they need it. Network setup was a snap, and the package includes Lexmark's fine administration software Mark Vision for managing your network printers. We also liked the unit's easy-to-attach modular duplexers and paper trays.

Three 12-ppm printers merit honorable mention: the HP LaserJet 5M, an Editors' Choice in this category last year; the IBM Network Printer 12; and the Xerox DocuPrint 4512. The LaserJet 5M (\$1,800 street, including the Ethernet adapter) was nearly as speedy as the Optra S 1250, and it, too, delivers excellent output. HP's JetAdmin management software sets the standard for the industry, and HP includes Web JetAdmin so you can check and configure the printer from any browser-equipped PC. The IBM unit (\$1,250 street, not including the Ethernet adapter—\$399 list) was easy to set up and comes with fine LAN and Web administration software. IBM's TonerMiser economy mode cuts per-page costs in half without much trade-off in print quality. The Xerox DocuPrint 4512 (\$1,270 street, not including the Ethernet adapter—\$379 list) is a value leader and is the only printer in its price range to include a duplexer as standard equipment.

Our Editors' Choice for medium-size workgroups (6 to 15 users) is the 16-ppm Lexmark Optra S 1650 (\$1,300 street, not including the adapter—\$499 list). It shares the same strengths as the Optra S 1250—modular accessories, excellent print quality, the MarkVision utility—in a more speedy con-

figuration. If your users need tabloid-size (11-by-17) output, the 20-ppm QMS 2060 EX (\$5,999 list, including the Ethernet adapter) is an excellent choice, and it deserves honorable mention.

If you're buying for more than 15 users, or for users with varied print needs, consider one of our two Editors' Choices in this class: the

Lexmark Optra N 245 and the QMS 2425 EX. The tabloid-capable Optra N (\$3,330 street, not including the \$310 Ethernet adapter) was the fastest 24-ppm printer on our tests, was easy to set up and manage, and is a good value. The 24-ppm QMS 2425 EX (\$5,499 list, including adapter), was an Editors' Choice in this category last year and is still a winner. QMS's Crown architecture and the printer's robust paper-handling and finishing options enable it to take over tasks from the office copier. For that functionality in one box, consider the 24-ppm HP LaserJet 5Si Mopier (\$9,459 list, including adapter), which merits an honorable mention. It delivers capabilities—tabloid printing, duplexing, sorting, stapling—that make it time- and cost-efficient for users to make multiple copies via the printer rather than at the copier, though jams and driver problems on our test unit kept us from rating it as highly as the QMS. The HP LaserJet 5Si MX (\$4,100 street, including adapter) also deserves an honorable mention, as does the IBM Network Printer 24 (\$3,425, not including \$399 adapter), a solid value.

In case you need a high-volume printer for enterprise applications, the 40-ppm QMS 4060 (\$19,999 list, including adapter) merits honorable mention. Its multitasking capabilities let it run at an awesome 33.6 ppm on one of our tests, and it comes with all the paper-handling options you're likely to need.



Standouts: Three Lexmark printers and one from QMS.

of 350 sheets for several of the reviewed printers to a generous 1,350 sheets for the Digital LN17ps (\$2,550 street).

The real action over the past year has been in 24-ppm departmental printers for groups of more than 15. Such departmental printers are adept at spooling multiple jobs internally, reducing network overhead. Optional bins give many models paper capacity of well over 2,000 sheets between refills, and add-ons such as sorters and staplers let you print, collate,

and staple multiple copies of a document without having to wrangle with a photocopy. All five of the 24-ppm lasers we reviewed can handle tabloid-size paper, ideal for producing large spreadsheets or oversize desktop publishing pages.

With at least twice the speed of small-workgroup printers and hefty monthly duty cycles, these products handle more users with fewer headaches for a network manager. That offsets their higher price—from \$3,300 to \$10,000—and

makes one unit a better choice than two 12-ppm units for many installations.

For enterprise-wide printing, the copier-sized, 40-ppm beasts boast staggering monthly duty cycles (typically 300,000 pages) and have impressive features such as on-the-fly toner replacement to minimize downtime. This class of machine is best for text-intensive, high-volume printing, as is needed in law offices or corporate back rooms. They are not cheap—at \$20,000 to \$25,000—but they come with oodles of ca-

Price/performance index

The QMS 2060 EX (\$5,999 list) is this roundup's price/performance leader. Its CrownAdmin software means excellent manageability for network administrators, and it handles multiple original jobs (or *mopies*) with aplomb thanks to QMS's advanced Crown architecture. Rated at 20 pages per minute (ppm), the tabloid-capable 2060 EX outperformed some of the 24-ppm units on our tests. The printer's somewhat high list price, however, makes it up to several thousand dollars more expensive than some of the 24-ppm units that we looked at for this roundup.

In the 12-ppm small-workgroup category, the price/performance leader is an Editors' Choice, the Lexmark Optra S 1250 (\$1,700 street, as tested). The sleek design of the letter- and legal-capable Optra S 1250 employs modular, stackable paper-handling options (duplexer, paper trays, and so on). Lexmark offers a high-quality 10/100 Base-T Ethernet adapter for the printer, which helped it

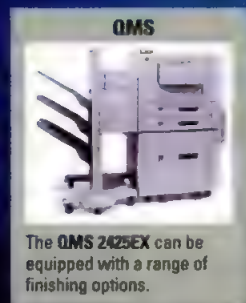
outperform every printer in its class. The same network card is available for another price/performance standout (as well as an Editors' Choice), the Lexmark Optra S 1650. It shares the same design as the 1250 but adds a faster engine and processor.

THE DATA POINTS

A printer's standard and optional features—engine and processor speed, networking and driver support, paper-handling capabilities, warranty—account for 75 percent of the overall performance/features score. A unit's performance on our battery of print speed and network tests accounts for the remaining 25 percent. We use the street price of the tested configuration except for products whose vendors don't cite a street price. You can find the relevant price/performance index data on our Web page at www.pcmag.com.

PERFORMANCE/ FEATURES

MOST BANG FOR THE BUCK



- Small-workgroup printers (12 ppm)
- Medium-size-workgroup printers (16–20 ppm)
- Departmental printers (24 ppm)
- Enterprise-wide printers (40 ppm)

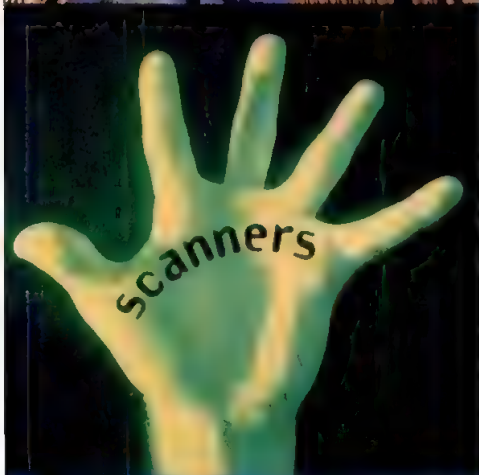
Dataproducts
(\$29,300)

HP D640 (\$25,669)

QMS 4060 (\$19,999)

PRICE

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BIRTH OF A MOPY

By this time you may have heard the term *mopying*—for *multiple original printing*—coined by HP and attached to what it sees as the next wave of shared printing devices. Instead of making the user print a single original and then make copies on a copy machine, mopying uses a printer to produce several originals of a document. The obvious benefit is higher-quality copies without a tedious and time-consuming trip to the copier.

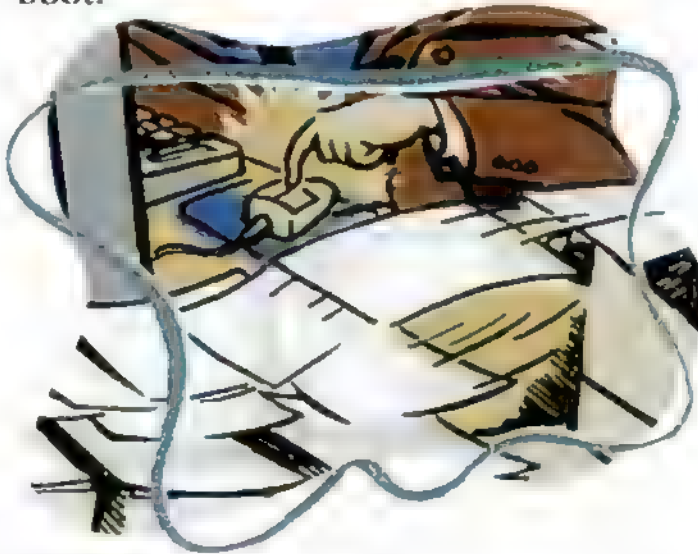
Printers designed to produce and collate multiple originals, such as the HP LaserJet 5Si Mopier, the Lexmark Optra N 245, and the QMS 2425 EX reviewed here, take that kind of task in stride. These machines take the job in once, holding the image of the final pages in memory or on a hard disk, image it the required number of times while collating on the fly, pumping out finished copies at greater speed than non-mopying printers offer. Some even duplex without slowing down very much. Expect all the major players in the printer market to have mopers soon (whether or not they use the term), but don't expect full-function models to trickle down to the bargain 12-ppm laser segment. You need at least 12MB of RAM and a hard disk (to buffer big print jobs) and at least a 24-ppm engine to make the technology work as advertised.

BEYOND MOPYING

The collating and stapling functions of first-generation mopers may be just the beginning. For example, Dataproducts' DDS-24, which was not ready in time for this roundup, is a 24-ppm moper with remote fax printing. It transmits and receives normal faxes at 200 dpi. If the device at the other end is another DDS printer, however, the document will be printed out just as it would on your local machine with all the print quality and features the receiving device supports.

Taking the concept a step further, Xerox has just announced its expandable Document Center Systems series. These modular printers can be upgraded to print, copy, fax, and scan for an entire network. The company is redesigning the components to reduce maintenance and to improve throughput over traditional

copiers. The Document Center System 20 and System 35 will be available by the time you read this, with upgrade modules following over several months. QMS offers a 300-dpi copy station add-on, CrownCopy (\$1,999 list), for its QMS 2425 EX and QMS 4060 models. And if you need more proof that network printing and office copying are converging, see the accompanying sidebar on the Canon GP200F. This hybrid marries a 24-ppm laser printer engine to a digital copier—and offers fax and scanning capabilities to boot.



EFFECTIVE MANAGEMENT

To maximize their investment, network administrators need to manage their printer resources efficiently. Some entry-level devices even come with sophisticated management utilities, which allow quick installation, configuration, and control of the printer over the network. These utilities can limit and track usage, alert managers to problems and maintenance needs, and allow precise tuning of job handling by the server.

During our testing we paid close attention to the quality of a product's installation and management software. The better ones—namely HP's JetAdmin, IBM's Network Printer Manager, Lexmark's MarkVision, QMS's CrownAdmin, and Xerox's nearly finished CentreWare—provide an accurate graphic illustration of each device with its current configuration and any problems that are occurring. You can also lock out the printer's physical control panel and protect it from overly ambitious users.

Right now, these administration utilities need to be loaded on and accessed through the network manager's workstation. By the time this article is in print, the major vendors will offer Web-based utilities that let the administrator control a printer remotely from any browser-

equipped PC. Although you can't add paper to a tray over a phone line, these new tools will save trips to reset an offline device or to update firmware—especially handy for administrators who have large sites to service and hence aren't at their own workstations most of the time.

NETWORK ISSUES

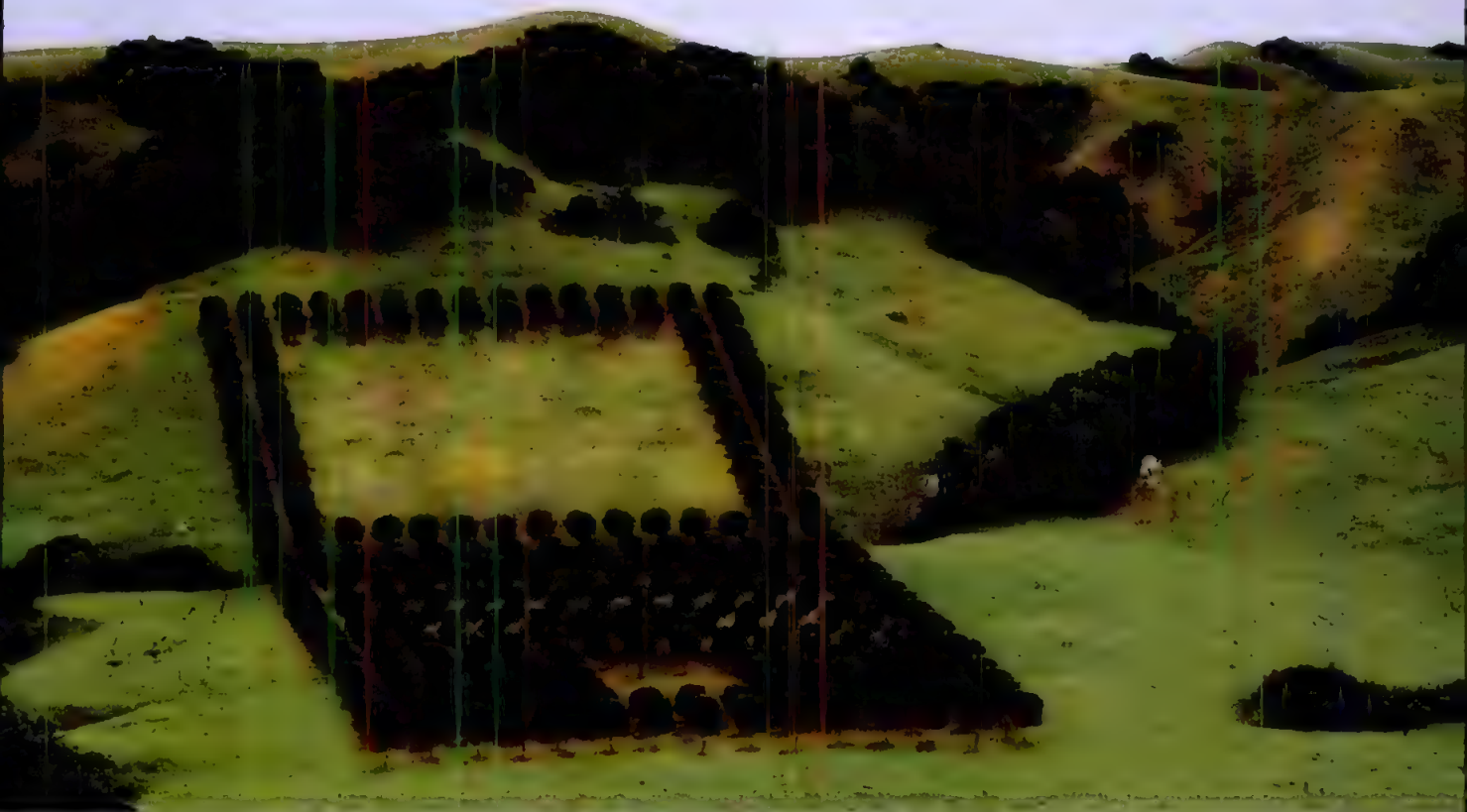
While these new features are exciting, other less obvious factors, such as a printer's ability to connect, can dramatically impact satisfaction on a busy network. Keep in mind that there is more to performance than just engine speed. If a device doesn't support the printer languages and protocols used in your company, no one will be able to use it. Be sure to budget for additional memory if there are a lot of graphics to print and you require PostScript.

The printer's *network interface card* is another item deserving attention. The \$400 to \$500 price tag for a typical printer adapter is well above the \$150 price tag for a good PC NIC. Our testing revealed that the NIC (along with such factors as controller speed and driver implementation) has an impact on performance.

All the printers we reviewed support TCP/IP and IPX, and most also support NETBeui. If you need DECnet, CCITT Group IV, or other less-standard language support, you'll have to shop more carefully. If you are using TCP/IP as a protocol, make sure the printer's software supports the Simple Network Management Protocol (SNMP), which is used for many intranet and Internet printing applications. You'll also want Management Information Base (MIB II) compliance, since MIB defines the way information is handled in a given SNMP environment.

A basic skill for any network printer is *multiprotocol support*—the ability to handle print jobs under different network protocols—and some do it better than others. Even though most printers support several protocols, some devices can handle jobs only using one of them at a time. Any requests received using an inactive mode are held off until jobs using the preferred protocol are finished. If IPX is the preferred protocol, for example, incoming IPX jobs will be serviced before any TCP/IP jobs. Simultaneous connectivity, the true standard of network connectivity, allows a printer to use and re-

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Echos P120E

120MHz Pentium® processor, 8MB RAM expandable to 40MB, 11.3" SVGA TFT display

\$1,999

Echos P100E

100MHz Pentium® processor, 8MB RAM expandable to 40MB, 10.4" SVGA TFT display

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Echos P100C

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Output showdown

With this newest batch of network lasers, one thing is clear: All the output is good or even outstanding, with only a rare exception. For text printing, the output we saw was crisp, clear, and sharp. One vendor's 600-dpi output was indistinguishable from another's. It was even difficult to tell 1,200-dpi text from 600-dpi text for everyday business letters in 10-point type. For graphics printing, there was more variation. Still, most of the output we produced looked similarly good at arm's length; it took closer scrutiny to reveal differences. In our samples below, better printers retained detail in the shadows of the model's face and showed a greater range of gray levels. Here, 1,200-dpi prints were noticeably better than 600-dpi prints. These samples were created from a high-quality .BMP image at each printer's highest offered resolution.



Kyocera FS-1700, 12 ppm, 600 dpi



Apple LaserWriter 12/640 PS Plus, 12 ppm, 600 dpi



Genicom microLaser 12, 12 ppm, 600 dpi



HP 5000 D840, 40 ppm, 600 dpi



Kyocera FS-3700, 18 ppm, 600 dpi



Brother HL-1860N, 17 ppm, 600 dpi



HP LaserJet 5M, 12 ppm, 600 dpi



IBM Network Printer 12, 12 ppm, 600 dpi



Lexmark Optra S 1250, 12 ppm, 1,200 dpi



Dataproducts Typhoon 40, 40 ppm, 400 dpi



HP LaserJet 5Si MX, 24 ppm, 600 dpi



IBM Network Printer 17, 17 ppm, 600 dpi



Lexmark Optra S 1850, 16 ppm, 1,200 dpi



Digital LN17ps, 17 ppm, 600 dpi



HP LaserJet 5Si Mopier, 24 ppm, 600 dpi



IBM Network Printer 24, 24 ppm, 600 dpi



Lexmark Optra N245, 24 ppm, 1,200 dpi

HARDWARE

Network Printers



Okidata Okipage 16n,
16 ppm, 1,200 dpi



QMS 2060 EX, 20 ppm,
1,200 dpi



QMS 2425 EX, 24 ppm,
600 dpi



QMS 4060, 40 ppm,
600 dpi



Xerox DocuPrint 4512,
12 ppm, 600 dpi

spond to supported protocols at any time, so jobs are printed in the order in which they are received.

Multitasking is another plus, allowing a new job to start processing as soon as memory is available, even while the previous one is still being printed. Better multitasking will result in better across-the-board performance as jobs stream in simultaneously.

Some printers use buffer memory and advanced memory management techniques to improve performance. File compression can reduce the time it takes to get the data into the printer, and compile-ahead technology (like that pioneered by QMS in its Crown architecture) lets the printer set up several operations in advance, such as rasterizing the image, setting paper handling options, and defining the collation order.

As for printer setup, this proved to be a stumbling block. The "Inside PC Labs" column in this issue's Trends section details our experiences, which were irksome to say the least. PC Labs received printers lacking drivers for major environments, or sometimes shipped with outdated manuals and shaky firmware. Even when all the pieces were present and accounted for, it often took several calls to technical support to get the printers on the network and functioning properly. The message is clear: Be sure of your supplier, and read the fine print. Make sure the product has shipping drivers and features you need before making an order.

CONSIDER THE DETAILS

Once you've settled the speed and networking questions, there are a few more factors to weigh before you buy.

Print quality was traditionally a differentiating factor among laser printer vendors, as the resolution bar moved from 300 dpi to 600 dpi to 1,200 dpi. All the printers this year offer at least 600-dpi printing except for the Dataproducts Typhoon 40 (a 400-dpi unit designed more for text-intensive output). Five can deliver 1,200 dpi with a RAM upgrade, while the QMS 2060 EX offers 1,200-dpi output in its standard configuration. With these higher resolutions, print quality is now less of a concern: The output is all good, and only a close look at a photo printout will reveal the differences between 600 dpi and 1,200 dpi.

In addition to the duplexers, sorters, and staplers already discussed, some vendors offer additional paper-handling options. Mailboxes can be dedicated to receive output for a specific user, workgroup, or job. Therefore, users don't have to sift through a pile of jobs to find their own—and private jobs stay private.

Per-page operating costs are another consideration. In high-volume environments, a lower cost per page can mean a printer pays for itself in two or three years. A double-spaced text page (estimated at 5 percent toner coverage) will generally cost you 2 cents per page in printer consumables (not including the cost of the paper). The IBM units offer a TonerMiser economy mode that cuts toner use in half. Kyocera's unique long-life amorphous silicon drum cuts that to just half a cent per page. The Dataproducts Typhoon 40, meanwhile, uses bottled toner and a photo drum with a replaceable film sheath and delivers pages for just a tenth of a cent per page.

Network printing continues to grow more complex. The new tools and features in the products reviewed here appeal to users, but add complexity to the life of network managers. The wide range of features and options makes detailed price and feature comparisons a must. Copy and advanced document handling may be just as important as speed and cost to some users, and the productivity improvements and better control offered by the printers in this review offer real advantages for the careful buyer. Printer vendors are rising to the challenge of the new network paradigm. Some faster than others.

APPLE COMPUTER INC.

LaserWriter 12/640 PS Plus

Apple's LaserWriter 12/640 PS Plus (\$2,200 street, including Ethernet adapter) is a fairly competent small workgroup printer. Its 600-dpi enhanced resolution PostScript output and solid paper handling make it a good choice for graphics-intensive users, and the price includes features that many vendors charge extra for, such as 12MB RAM and a duplexer.

True to its graphics mission, the LaserWriter includes only PostScript drivers. If you want to use the PCL 5 em-

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3Com 3C905-TX Fast Etherlink XL PCI 10/100 Network Card or 33.6Kbps Fax/Modem
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Altec Lansing Stereo Speakers
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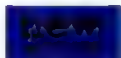
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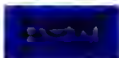
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HARDWARE

Network Printers

ulation, you must install an HPIIID driver, which does not take advantage of some of the advanced printing features such as FinePrint and PhotoGrade image enhancers. The documentation is well-written and thorough, but it lacks installation instructions for setup on a Windows NT 4.0 network.

The LaserWriter bundle is scant on network management tools. To create a print server on Novell 4.x networks, we needed to use NetWare's PConsole in bindery mode. And although the Apple Printer Utility is an adequate configuration tool, it provides no means to install network printers or manage print queues.

Our NetWare setup proceeded smoothly with only one exception: Even



The LaserWriter's enhanced-resolution PostScript targets graphics-intensive users.

when we set the printer to auto-detect the NetWare Frame Type, we still needed to configure the Frame Type manually before the network could see it. The Apple Printer Utility made it easy to configure the unit for TCP/IP printing, but to add and to configure the proper ports and services required some familiarity with Windows NT Server 4.0.

The LaserWriter's image enhancement and paper handling features are impressive. Apple's PhotoGrade lets you boost graphics resolution up to 1,200 dpi. The printer comes standard with 830 sheets of input capacity and includes auto-tray switching.

The LaserWriter was generally slower than the other 12-ppm units on our performance tests. But if you print a lot of graphics, the Apple LaserWriter 12/640 Plus is one of the better choices for small workgroups.—*Scott Kelly*

Apple LaserWriter 12/640 PS Plus. Street

price: Basic configuration (as tested) \$2,200. Apple Computer Inc., Cupertino, CA; 800-462-7753, 408-996-1010, www.imaging.apple.com. *Circle 455 on reader service card.*

BROTHER INTERNATIONAL CORP.

Brother HL-1660N

In the Brother HL-1660N (\$1,500 street, not including the Ethernet adapter—\$399 list), Brother International Corp. delivers a letter- and legal-size 17-ppm printer for medium-size workgroups at the price of a 12-ppm small workgroup laser. Unfortunately, its performance was more on a par with that of the 12-ppm units, and it was below par in most other areas, too.

Setup on our NetWare network was fairly easy. Although Brother's printer utilities are light on installation and network management details, NetWare's PConsole and the Netcard manual helped to make the install quick and painless. By contrast, hooking the printer up to our Windows NT 4.0 network was no easy matter. The documentation lacked installation instructions. In fact, we came on the configuration instructions for TCP/IP printing under the *Unix* section. It took a detailed fax from Brother's technical-support team to get us up and running.

The printer switched smoothly between PCL 5e and PostScript 2 emula-



Though rated at 17 ppm, the HL-1660N performed more like one of the 12-ppm units.

tion, with far superior output from the PCL. In general, however, the text and graphics output was well below average compared with that of other 600-dpi lasers. Characters were less defined than with the other printers, and we had to

tweak the driver settings to get a decent photo image, since the printer's default settings tended to posterize images.

Performance, too, was disappointing. The Brother HL-1660N trailed its 16- and 17-ppm competitors on every test, and turned in times more in line with (and often below) the 12-ppm units. On our Multiple Simultaneous Jobs test, the 17-ppm HL-1660N had an effective throughput of only 6.5 ppm; the better 12-ppm units delivered more than 11 ppm.

If you need a 17-ppm class machine for a medium-size workgroup, you'll have to look elsewhere. And given the Brother's inferior print quality, one of the comparably priced 12-ppm units might make a better choice.—*SK*

Brother HL-1660N. Street price: Basic configuration (as tested), \$1,500. Brother International Corp., Somerset, NJ; 800-827-6874, 908-356-8880; www.brother.com. *Circle 456 on reader service card.*

DATAPRODUCTS CORP.

Dataproducts Typhoon 40

The Dataproducts Typhoon 40 (\$28,500 street, including Ethernet adapter) is one serious paper pusher. It is one of the three printers we tested that fall in the 40-ppm class, and is ideal for departments that print large volumes of text documents. The 400-dpi Typhoon has a rated duty cycle of 300,000 pages per month. Cost per page (plus the cost of paper) is a fraction of a cent compared with 2 cents for a typical laser. Combine that with robust features the typical network laser can't match—such as 24MB of RAM standard, a 2,500 sheet paper capacity, and output up to tabloid size (11 by 17 inches)—and the initial cost becomes much less daunting.

The Typhoon 40's unique design features enhance throughput and reduce expenses. You can add paper and toner while the unit is running, so you can operate the unit continuously. And instead of replacing the entire drum, you replace only the drum's outer sleeve.

The Typhoon 40 comes up short in terms of emulation. It supports only PCL at 300 dpi, and Xionics PostScript Level 2 and line printer emulation at 300 and 400 dpi, and its graphics print quality trails its competitors. On the plus side, the 540MB hard disk lets you store PCL



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PERFORMANCE TESTS

Network Printers



All these printers produced fast, single-sided copies of plain text documents, but when we taxed them on a variety of complex operations—such as printing graphics or mopying—some met the challenge squarely, while others stumbled.

What the Numbers Mean

To do well on our **50-Page Simplex** test, the printers had to receive data quickly through the network port and process pages efficiently. Top 12-ppm performers were the Lexmark Optra S 1250, which can process up to four jobs at a time, and the HP LaserJet 5M, which can process three.

Key to good performance on our **50-Page Duplex** test was ample memory and good paper-path and duplex design. Duplexing requires that two complete pages reside in the printer's memory. For maximum efficiency, the second page is usually printed first to ensure that the output is stacked in the proper order. Even though duplex printing outputs half the number of pages as single-sided printing, our tests showed that page-flipping, memory management, and paper-path mechanics put a substantial drag on performance.

The 12- to 24-ppm units took up to one and a half times as long—and in one case more than twice as long—to complete the 50-Page Duplex as the 50-Page Simplex test. By contrast, the 40-ppm printers took only a minimal performance hit for duplexing. The HP 5000 D640 and the QMS 4060 took only a few seconds longer to print duplex. The Dataproducts Typhoon 40 was the slowest of the three 40-ppm printers. It distinguished itself, however, by printing simplex and duplex jobs at nearly the same speed—thanks to its 300-dpi resolution, which requires less memory and time to image the page.

Duplexers fall into two categories: internal and stackable. The 24- and 40-ppm models (as well as the IBM Network Printer 17) use internal-duplex modules that flip the pages over within the printer. The 12- and 17-ppm units—from Brother, Digital, Kyocera, and Lexmark—each use a stackable-duplex module that sits beneath the printer. We found, however, that the duplexers' style affected performance much less than its overall design quality.

Our **12-Page Text** and **12-Page Text and Graphics** tests showed the performance differences between printing a text-only (or unformatted) document and a text-and-graphics (or formatted) document. The printers processed our unformatted document quickly because the file was small and its information simple to compress, decode, and print. To process the formatted document, however, the printer driver had to compress the data at a higher level before spooling it to the network queue; then the printer had to decode the data in order to print it. For large formatted files, a printer might spend more time decoding a file than it would have spent processing the same file uncompressed.

Large files can also create bottlenecks at the network interface

card; once the NIC's memory buffer is filled, data transmission stops while the NIC passes the data off to the printer. Once a full page of data reaches the printer, it begins to process the data. Key performance factors include how quickly the printer rasterizes the file and how fast the engine moves the paper.

For the 12-page text document, two top 12-ppm performers were the Lexmark Optra S 1250 and the Kyocera FS-1700. The high mark the FS-1700 garnered for the text-only document dropped dramatically for the text-and-graphics document. Most notable were the Kyocera printers, which stalled on the bitmapped images, pausing for long periods when spooling and processing the document.

In the 16- to 20-ppm class, the top performer was the Kyocera FS-3700, outperforming the last-place Brother HL-1660N by 24 seconds on the text document. The Lexmark Optra S 1650, Okidata Okipage 16n, and QMS 2060 EX also clocked impressive times. On the formatted document, however, the FS-3700 experienced problems similar to the FS-1700, as did the HL-1660N. By contrast, the Network Printer 17, the Digital LN17ps, and the

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place within each category.

Rated speed **50-Page Simplex**
Minutes:seconds

SMALL-WORKGROUP PRINTERS

Apple LaserWriter 12/640 PS Plus	12 ppm	5:04	
Genicom microLaser 12	12 ppm	4:16	
HP LaserJet 5M	12 ppm	4:19	
IBM Network Printer 12	12 ppm	4:41	
Kyocera FS-1700	12 ppm	5:04	
Lexmark Optra S 1250	12 ppm	3:48	
Xerox DocuPrint 4512	12 ppm	4:28	

MEDIUM-SIZE-WORKGROUP PRINTERS

Lexmark Optra S 1650	16 ppm	3:10	
Okidata Okipage 16n	16 ppm	4:10	
Digital LN17ps	17 ppm	3:27	
Brother HL-1660N	17 ppm	4:39	
IBM Network Printer 17	17 ppm	3:24	
Kyocera FS-3700	18 ppm	3:31	
QMS 2060 EX	20 ppm	2:41	

DEPARTMENTAL PRINTERS

HP LaserJet 5Si MX	24 ppm	2:37	
HP LaserJet 5Si Mopier	24 ppm	2:37	
IBM Network Printer 24	24 ppm	2:31	
Lexmark Optra N 245	24 ppm	2:14	
QMS 2425 EX	24 ppm	2:45	

ENTERPRISE-WIDE PRINTERS

Dataproducts Typhoon 40	40 ppm	2:02	
HP 5000 D640	40 ppm	1:23	
QMS 4060	40 ppm	1:36	

◀ BETTER

N/A—Not applicable. The configuration we received did not support duplexing.
* Collating was set through the printer driver, not the word processing application.

Optra S 1650 took only 7 to 12 seconds longer to print the formatted document.

All the printers in the 24-ppm class printed the unformatted document in less than 1 minute and took only slightly longer to print the formatted document. The QMS 2425 EX printer showed the smallest performance drop from text-only to formatted documents, a result of the multitasking Crown Architecture's unique process called Display List. This lets QMS printers convert the PostScript data into its proprietary Display List format, which is highly descriptive, efficient, and compressible. Thus, the printer stores more pages in memory and never waits for data to process.

In the 40-ppm class, the QMS 4060, which uses a Fujitsu engine and a 100-MHz 64-bit NEC Vr4300 RISC processor, outperformed the competition. The formatted document proved an obstacle for the Dataproducts Typhoon 40 and the HP 5000 D640. The D640 slowed down considerably; the culprit was probably the HP4si driver recommended by HP (the native drivers were not ready at test time). However, we also observed

that the D640 would periodically pause, then quickly output a batch of pages.

Our **Multiple Simultaneous Jobs** test revealed how many print jobs were active in the network print queue simultaneously and the time it took to print them. For example, if two jobs are active, the printer processes the first document while the NIC receives data for the second. The number of jobs a printer can process at once depends on many factors, including the amount of memory both in the NIC and in the printer (including the size of the internal hard disk, which can act as virtual memory), the type and size of the job, whether the printer's operating system can handle concurrent processing (receiving, processing, and printing), and the speed of the NIC.

In the 12-ppm category, the LaserJet 5M and Optra S 1250 outperformed the other printers in its class. Each processed multiple jobs simultaneously (three and four jobs, respectively), and each had excellent speed. We attribute the Optra S 1250's performance to its PCI controller and PCI bus, which let the printer transfer data from the NIC to memory faster; the LaserJet 5M's performance

50-Page Duplex Minutes:seconds	12-Page Text Minutes:seconds	12-Page Text and Graphics		Multiple Simultaneous Jobs			Multiple Copies of a Single Job Minutes:seconds
		Minutes:seconds	File size ▼	Minutes:seconds	Effective ppm ▲	Concurrent jobs ▲	
7:47	1:35	2:07	0.7MB	8:20	7.2	1	7:41
N/A	1:20	1:46	0.7MB	7:16	8.3	1	8:04
4:28	1:17	1:21	0.7MB	5:02	11.9	3	6:23
N/A	1:31	1:39	1.5MB	5:25	11.1	1	6:56
N/A	1:12	3:47	3.4MB	15:38	3.8	1	17:10
4:17	1:11	1:27	1.8MB	5:04	11.8	4	5:24*
6:04	1:12	2:00	1.8MB	7:22	8.1	1	7:22
3:21	1:03	1:15	1.8MB	3:59	15.1	4	4:15*
N/A	1:06	1:39	1.6MB	4:38	12.9	1	6:54
4:27	1:11	1:23	1.7MB	4:04	14.8	1	4:47
6:12	1:15	2:22	1.5MB	9:13	6.5	1	10:06
4:13	1:07	1:14	1.5MB	3:47	15.9	1	4:34
4:24	0:51	3:01	3.4MB	12:01	5.0	1	13:51
3:24	0:55	1:33	0.4MB	3:16	18.4	3	3:26*
3:02	0:49	1:08	1.7MB	2:58	20.1	2	3:38*
3:18	0:46	1:00	1.7MB	3:31	17.1	2	3:44*
5:36	0:59	1:09	1.5MB	3:21	17.9	1	4:04
3:01	0:48	0:59	1.8MB	2:42	22.2	3	2:57*
3:33	0:56	1:02	0.7MB	3:11	18.8	2	3:18*
2:05	0:44	1:06	1.2MB	3:06	19.4	1	3:50
1:35	0:31	1:05	1.5MB	5:00	12.0	1	4:11
1:45	0:36	0:30	0.4MB	1:47	33.6	5	1:48*
◀ BETTER	◀ BETTER	◀ BETTER		◀ BETTER			◀ BETTER

PERFORMANCE TESTS

was enhanced by the PCL6 driver. The IBM Network Printer 12, which only printed jobs sequentially, came in third, thanks to an especially efficient internal NIC.

The same NIC used in the Network Printer 12 also accounts for the Network Printer 17's top score in its ppm class. The Optra S 1650, which was the only printer in its class to process multiple jobs concurrently, clocked the second-fastest time.

On the Multiple Simultaneous Jobs test, the 20-ppm QMS 2060 EX edged out two higher-rated 24-ppm printers, the IBM Network Printer 24 and the HP LaserJet 5SiMopier. The 2060 EX printed close to engine speed (18.4 ppm) and processed up to three jobs concurrently. We attribute its fine performance in part to QMS's multitasking Crown Architecture, which enables units to perform job spooling from the NIC and interpret and rasterize in the printer simultaneously. The 2060 EX was also equipped with 48MB of RAM, which gave it a slight advantage over the higher-rated 24-ppm QMS 2425 EX, which had only 24MB.

The Lexmark Optra N 245 was the top-ranking 24-ppm printer, processing up to three jobs simultaneously and printing close to rated engine speed (22.2 ppm). The runner-up LaserJet 5Si MX took 16 seconds longer than the Optra N to complete the five print jobs. Surprisingly, the LaserJet 5Si MX performed better than the LaserJet 5SiMopier, although both use the same engine. While the LaserJet 5Si MX printed steadily and smoothly, the LaserJet 5SiMopier paused between the third and fourth print jobs.

The QMS 4060 came out on top in the 40-ppm category, printing the five documents in under 2 minutes. By contrast, the HP 5000 D640 printed at a sluggish 12 ppm. The bottleneck might have been caused by its network connection, which consisted of an external Jetx Box attached to the parallel port, instead of a NIC card.

For the **Multiple Copies of a Single Job** test (our test of a printer's mopy capabilities), we printed the 12-page formatted document five times. The units from Lexmark and QMS, as well as the HP LaserJet 5Si MX and the HP LaserJet 5SiMopier, offered "mopying" features. This allows the printer driver to send the job only once to the printer, which outputs the required number of copies, collated. (An asterisk placed next to the reported timing indicates that the printer has mopying capability.)

Although the collate function resides internally on mopiers, you can collate a job using a printer that lacks internal collation by activating the collation feature in an application, such as Microsoft Word 7.0. This method is murder on network traffic, because it spools each copy of the document before sending one large file to the network queue. So, on a five-copy job, Word would send a file to the queue that is five times the size of the original.

When we printed multiple simultaneous jobs with Word 7's collation feature disabled on printers that don't mopy, the units predictably printed 5 copies of the first page, 5 copies of the second, and so on, uncollated. But before we could run the same job on one of the mopying units, we first had to turn off Word's collation feature, then enable the collation feature in the printer driver.

The Optra S 1250 and Optra S 1650 beat out the competition; they were the only printers in their classes (12 and 16 ppm) to include mopy capability. As our tests revealed, however, internal collation doesn't necessarily translate into faster print speed. The 12-ppm HP LaserJet 5M, which doesn't mopy, also had good speed, thanks to its highly efficient PCL 6 driver.

All printers that qualified passed our **Emulation Switching** test

(not charted here), which evaluated how well a printer switched between PCL and PostScript document printing. Excused from the test were the Network Printer 12 and FS-1700, which don't include a PostScript option, and the Typhoon, which was unable to print our PostScript Level 2 document.

The **Protocol Switching** test (also not charted) evaluated how well a printer processed IPX jobs sent over a NetWare 4.11 network and TCP/IP jobs sent from a Microsoft Windows NT 4.0 server. All the printers were able to process jobs sent using both protocols; however, not all were able to interleave the jobs. Both the Okidata 16n and the Xerox DocuPrint processed the IPX jobs first, then printed the TCP/IP jobs when the NetWare queue was empty. This may be of little concern on a small network, but if you have multiple servers running different protocols, you may want to think twice before purchasing either printer. We were pleased to note that the Hewlett-Packard units successfully interleaved IPX and TCP/IP jobs. The units we reviewed last year serviced the entire NetWare queue before allowing TCP/IP jobs through. This year, the HPs got it right.—*Analysis written by Laura Cox and Denis Tom*

How We Tested

All speed tests were conducted on a NetWare 4.11 network. A specific queue was set up for each printer, and the print server was set to poll the NetWare queue once a second. Each test-bed consisted of two Micron Millennia Pentium/166 systems running Microsoft Windows 95 and Microsoft Word 7.0, with 16MB of RAM, a 2GB Western Digital Caviar 2600 EIDE hard disk, and a Diamond Stealth 2000 3-D video card running at 800-by-600 with 256 colors. For NDS support, we installed Novell's Client 32, and we configured the NetWare server in NDS mode with Bindery emulation. We also set up a Microsoft Windows NT 4.0 server with TCP/IP for our Protocol Switching test. We ran all tests from Microsoft Word 7.0.

The **50-Page Simplex** test measures a printer's speed in producing a single-sided Word document with a mix of text and simple, highly compressible graphics.

The **50-Page Duplex** test measures a printer's speed in producing the same document using the duplex option.

The **12-Page Text** test measures a printer's speed in producing a Word text document consisting of purely unformatted text. The document contained the unstyled, 12-point TrueType fonts Arial, Courier, and Times New Roman.

The **12-Page Text and Graphics** test measures a printer's speed in producing a Word document with heavily formatted text and graphics. The graphics consist of two half-page bitmapped images, one a photograph, the other an image with a large amount of black.

The **Multiple Simultaneous Jobs** test measures how well a printer's internal NIC processes a steady stream of data. We took the printer off-line, then sent the 12-page formatted document to the printer five times. Keep in mind that the recorded times don't include the time it took each job to spool to the queue.

The **Multiple Copies of a Single Job** test measures a printer's speed in producing the 12-page formatted document five times, collated. For printers that don't offer internal collation, we enable the collation feature in Word. For printers that do, we turn off Word's collation feature.

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Network Printers

macros, fonts, and forms.

This isn't an end-user installable printer: The price includes a visit by a technician to set it up. The PrintWatch utility supports only basic alerts such as online, off-line, and out of supplies, although PrintWatch does let you track

ally a repackaged Xerox DocuPrint 4517s wearing the Digital logo, the unit offers good speed, 1200-dpi PostScript output, high capacity, and a wide array of options. One caveat, however: Digital does not yet offer administration software for Windows 95 or Windows NT for the printer.

Setup for the LN17ps was uneventful using NetWare's PConsole. Digital's administration software, Document Services for Printing (DS/P), lets you track usage, and sends out an alert if the printer is jammed, off-line, or out of paper. Right now, however, DS/P only works under DOS and Windows 3.1. To check printer status on our test configuration, we had to rely on the front panel LED and a physical inspection. The menus on the panel are reasonably clear, so if your desk is close by, you won't miss the screen reports. But if remote control and detailed tracking is an imperative, look elsewhere.

Output quality in default 600-dpi mode was very good and comparable to its 600-dpi competition; TruRes-enhanced 1200-dpi prints were even better, with crisp text and with a fine range of tones in gray-scale images. The LN17ps placed in the middle of the 17-ppm pack on our performance tests. On our Multiple Simultaneous Jobs test, the unit produced 14.8 ppm.

Digital is well known for excellent printer administration software; we only

Digital Equipment Corp., Marlboro, MA. 800-365-0696; www.printers.digital.com. Circle 459 on reader service card.

GENICOM CORPORATION

microLaser 12

Targeted at small workgroups, the Genicom microLaser 12 (\$1,599 list, not including the \$399 Ethernet adapter) is a reasonably priced letter- and legal-capable 12-ppm unit that offers good 600-dpi output with fairly good speed. But as a network device, it has miles to go before it can compare well with other models in its class. Genicom, a player in the high-volume printer arena, acquired the microLaser line when it purchased the printer division of Texas Instruments last year. The company plans to address the microLaser's shortcomings.

Setup for the unit on our Novell network was horrendous. We expected the Ethernet adapter—designed to work with NetWare 3.x networks—to work with NetWare 4.x networks in bindery mode. When we encountered setup problems, we turned first to the manual, then to technical support. It took an on-site visit from a Genicom engineer (who replaced the Ethernet card) to complete the installation. During testing, we had trouble getting the NIC to see the server.

We found the microLaser 12's printer management utility limited and flaky. It offered neither printer status alerts or queue management capability, and when we made changes to the printer's network settings, they didn't always take effect.

The printer's best feature is true Adobe Postscript Level 2 support, which produced excellent text and graphics. But output using the PCL 5e emulation driver was a disappointment. According to Genicom, the microLaser 12 is optimized for PostScript printing; PCL drivers are included only to support older applications that require it. The PCL drivers print text at 600 dpi, but we could only get it to produce 300 dpi for raster graphics, even when we installed additional memory.

On a more positive side, we liked the printer's paper-handling features. Adding paper and envelopes was simple. Auto-tray switching—from standard to letter-head, for instance—worked well. One drawback, though, is the absence of a du-



Though it is one of the slower paper-pushing beasts, the Typhoon 40 never needs to rest.

usage by department. Oddly, a paper jam is reported as an off-line condition. The printer recovers well from jams, reprints the mangled page, and continues with the queued jobs.

The Typhoon 40 was not a standout on our tests, delivering 19.4 ppm on our Multiple Simultaneous Jobs test. That's ahead of the HP 5000 D640's 12.0 ppm, but well behind the QMS 4060's 33.6 ppm. Still, the Typhoon 40 remains a good choice for installations that require high-volume, high-capacity, continuous operation. Its unbeaten cost-per-page can help customers get back their investment.—James Karney

Typhoon 40. Street price: Basic configuration, \$28,500; tested configuration, \$29,300. Dataproducts Corp., Simi Valley, CA; 800-980-0374, 805-578-4000; www.dpc.com. Circle 458 on reader service card.

DIGITAL EQUIPMENT CORP.

Digital LN17ps

Those in the market for a basic letter- and legal-size 17-ppm printer for a medium-size workgroup might want the Digital LN17ps (\$2,550 street, not including the Ethernet adapter—\$499 list). Re-

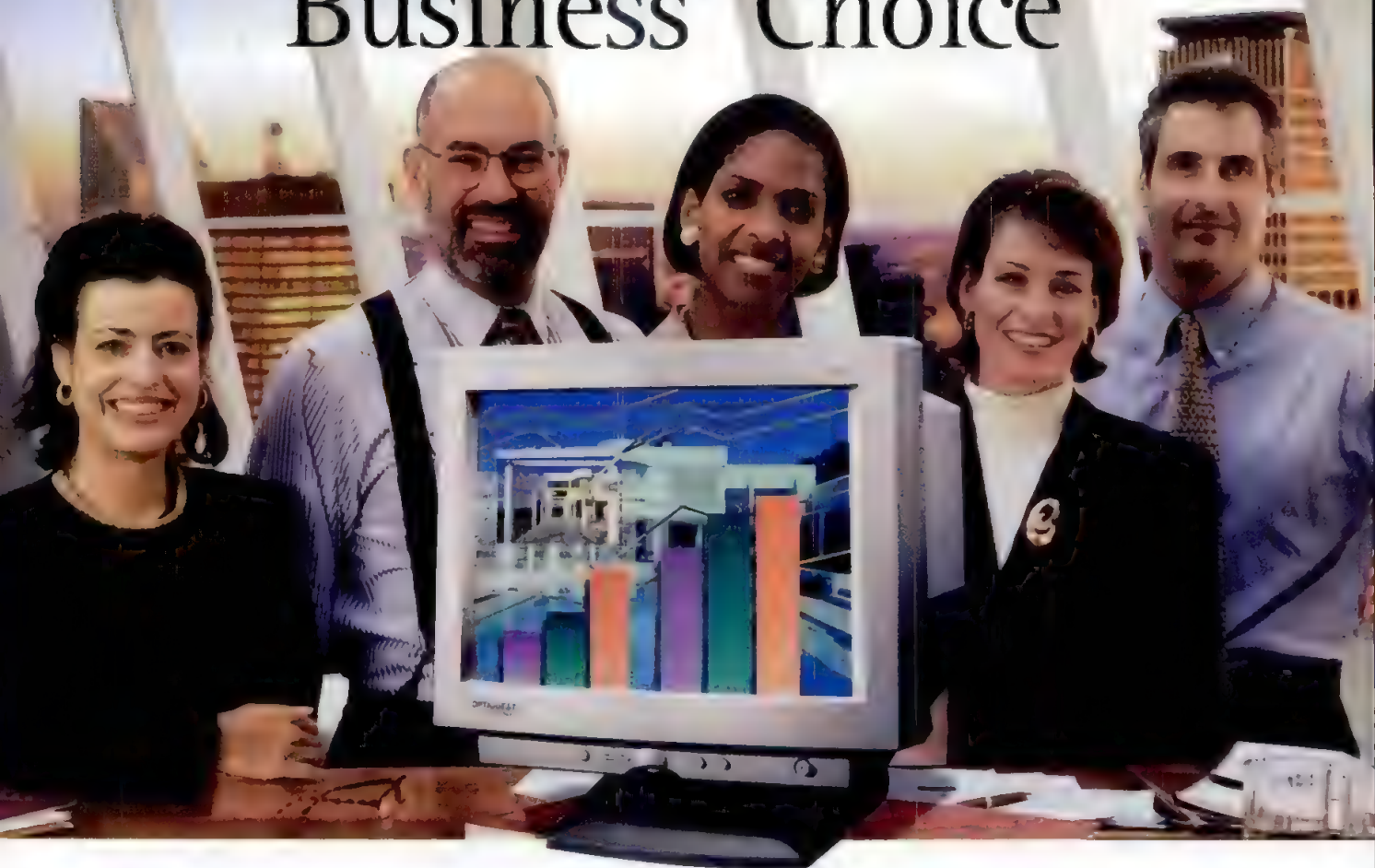


The LN17ps needs only Windows 95 and Windows NT for its admin software to really shine.

wish the company had seen fit to develop 32-bit versions by now. If you can do without it, the LN17ps's performance and features may make it an attractive choice for small workgroups.—JK

Digital LN17ps. Street price: Basic configuration, \$2,550; tested configuration, \$5,500.

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Editors' Choice

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	Q100	V775	V773	Q71	V655	Q53	V641
Size/Viewable	20"/18.4"	17"/16.0"	17"/15.8"	17"/16.0"	15"/13.8"	15"/13.8"	14"/13.2"
Dot Pitch	0.28mm	0.26mm	0.26mm	0.28mm	0.28mm	0.28mm	0.28mm
Max. Resolution	1600 x 1280	1600 x 1280	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024	1024 x 768
Horz. Scan Freq.	30-86kHz	30-85kHz	30-69kHz	30-70kHz	30-65kHz	30-70kHz	31.5/37.5-48.4kHz
MSRP	\$1,149	\$699	\$599	\$559	\$339	\$319	\$229

Prices effective April 1, 1997

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Optiquest V775
October 1996

HARDWARE

Network Printers



The microLaser 12 is an adequate standalone, but as a network printer it has miles to go.

plexing option. In testing, the printer performed reasonably well against the 12-ppm contenders, though its 8.2-ppm throughput on our Multiple Simultaneous Jobs test was below average. If you need an easy-to-install network printer for small workgroups, there are better units available. —SK

microLaser 12. List price: Basic configuration: \$1,599; tested configuration, \$2,297. Genicom Corp., Chantilly, VA; 800-836-4266; 540-949-1000. www.genicom.com. Circle 460 on reader service number.

HEWLETT-PACKARD CO.

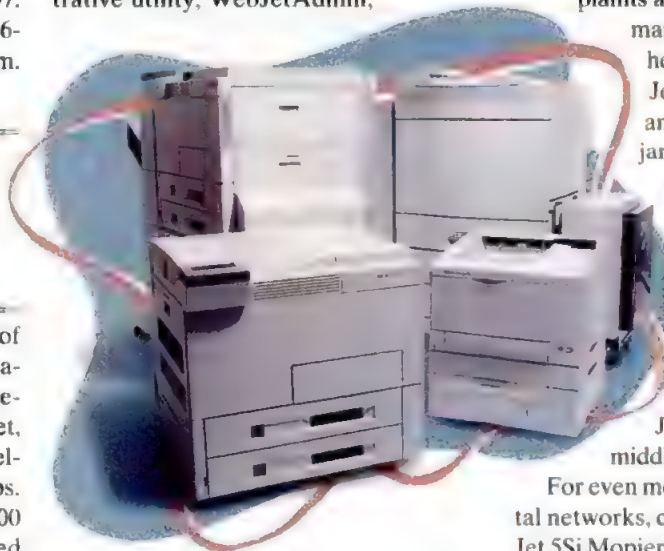
HP LaserJet 5M,
HP LaserJet 5Si MX,
HP LaserJet 5Si Mopier,
HP 5000 D640

Hewlett-Packard is fielding a full line of new printers this year with an emphasis on ease of use and simplified management. The HP LaserJet 5M (\$1,800 street, including Ethernet adapter) is an excellent 12-ppm unit for small workgroups. The 24-ppm HP LaserJet 5Si MX (\$4,100 street, including adapter) offers the speed and options for departmental printing, while the HP LaserJet 5Si Mopier (\$9,549 list, including adapter) adds finishing capabilities that let it take over tasks from the office copier. These printers are fine performers and deliver superb paper handling and management features. For enterprise applications, the 40-ppm HP 5000 D640 (\$14,995 list, not including the \$349 Ethernet adapter) is an elegant high-volume workhorse.

The 12-ppm LaserJet 5M is well suited

for small workgroups. This 600-dpi, letter- and legal-capable unit features a built-in network card and supports both Adobe PostScript and PCL 6. Its duplexer (\$679 list) attaches to the back of the printer. Setup was especially easy using HP's fine administrative software, JetAdmin. It provided a common interface to attach the printer to the network to load drivers and to create print queues. You can also use it to configure any menu setting available on the 5M's bright and legible scrolling LED control panel, and there is a cancel button on the front panel that lets you kill the current job. Other design extras include flash memory and an infrared port for wireless printing from a laptop.

JetAdmin's outstanding network administrative tools let you monitor, adjust, and delete print jobs, filter who receives dialog-box and audio alerts, and tally printer usage. A labeled graphic display changes color to report at-a-glance status, paper types and levels, and toner level in the cartridge. HP's Web-based administrative utility, WebJetAdmin,



From a 12-ppm small-workgroup printer to a high-volume paper pusher, each of these HP printers is a good choice.

lets managers graphically view any printer (even non-HP units) over a wide area network and configure HP models via any PC anywhere with a Web browser.

The LaserJet 5M is one of only three printers we tested that support PCL 6 (two of the Lexmarks did as well)—the new language designed to provide faster graphics

printing and better gray-scale output. It produced clean images with excellent tonal range. Although PCL 6 didn't dramatically improve image quality over PCL 5e, its improved WYSIWYG font handling and object-oriented commands speed up text and complex graphics printing.

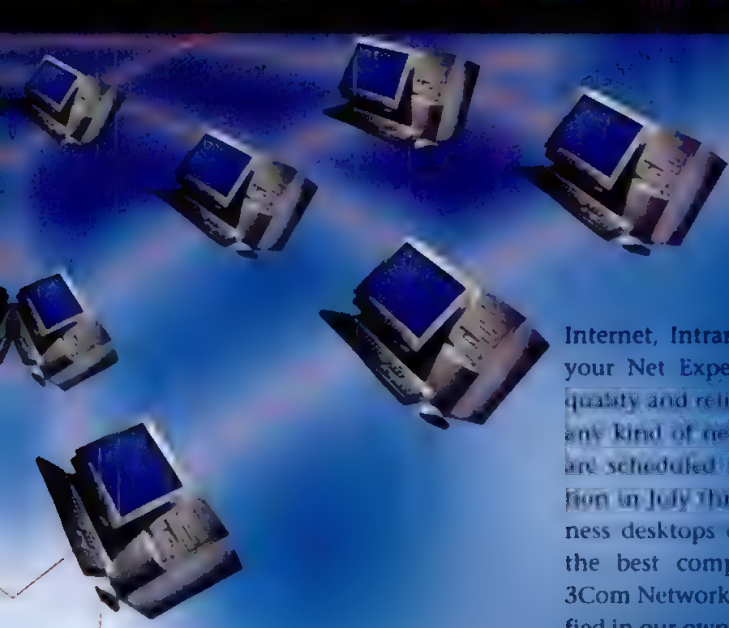
The LaserJet 5M's performance was excellent, taking the top scores in our 12-page Text and Graphics and Multiple Simultaneous Jobs tests. It produced an impressive 11.9 ppm. The LaserJet 5M's range of features makes it ideal for small to medium-size workgroups.

The 24-ppm HP LaserJet 5Si MX offers a host of options matched to larger network demands, such as tabloid-size printing, a 2,000-sheet bin (\$1,299 list) that brings paper capacity to 3,100 sheets total, a duplexer (\$669 list), a stapler (\$2,665 list), and an eight-bin mailbox (\$1,889 list) that lets you dedicate individual bins to a specific person, workgroup, or job. One flaw is that there is no stapler.

Setup and management were identical to the LaserJet 5M—with the same complaints about NDS operations. The manuals are complete and heavily illustrated. The LaserJet 5Si MX is solidly built, and was all but impossible to jam. Print quality was clean and black, and gray-scale images showed good tonal range. The LaserJet 5Si MX's performance was on a par with the other 24-ppm contenders. It produced 20.1 ppm on our Multiple Simultaneous Jobs test, placing it in the middle of the pack.

For even more demanding departmental networks, consider the 24-ppm LaserJet 5Si Mopier. It is designed to substitute as a copier for some tasks, producing multiple original prints (or *mopies*). A multi-copy job is sent once to the printer, which then collates the job electronically. Based on the LaserJet 5Si, the LaserJet 5Si Mopier adds a 420MB hard disk, a 2,000-sheet bin, multibin mailboxes, a stapler, and a duplexer. Users can have the printer print, collate, and staple output without having to use a copier.

In hands-on testing the LaserJet 5Si Mopier performed well. We ran a series



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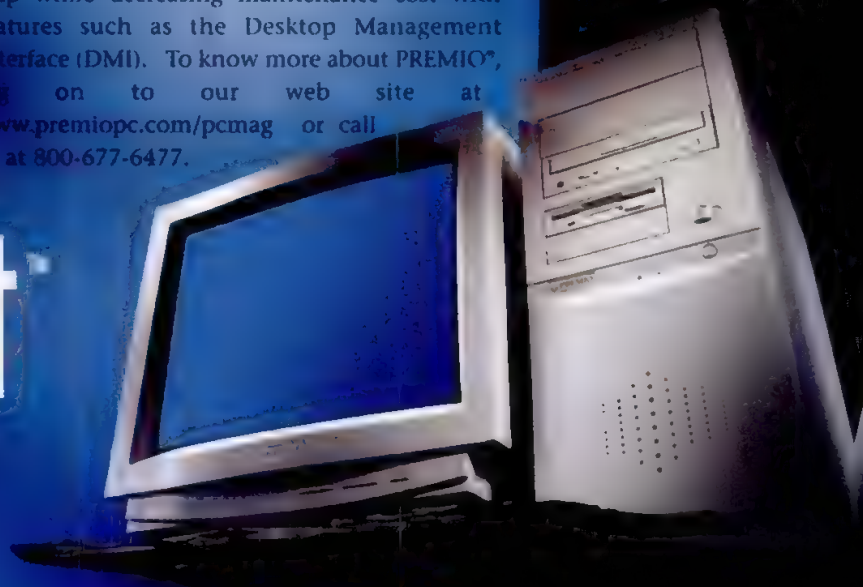
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SUMMARY OF FEATURES

Network Printers

■ YES ■ NO □ OPTIONAL

In alphabetical order by company

	Apple LaserWriter 12/640 PS Plus	Brother HL-1660N	Dataproducts Typhoon 40	Digital LN17ps	Genicom microLaser 12	HP LaserJet 5M	HP LaserJet 5Si MX	HP LaserJet 5Si Mopier
Rated engine speed	12 ppm	17 ppm	40 ppm	17 ppm	12 ppm	12 ppm	24 ppm	24 ppm
List/street price, basic configuration	\$2,319, \$2,200	\$1,799, \$1,500	\$33,495, \$28,500	\$2,879, \$2,550	\$1,599, N/A†	\$2,229, \$1,800	\$4,899, \$4,100	\$9,549, N/A†
List price of Ethernet adapter	Included	\$399	Included	\$499	\$399	Included	Included	Included
List/street price, tested configuration	\$2,319, \$2,200	\$1,799, \$1,500	\$34,490, \$29,300	\$5,566, N/A†	\$2,297, N/A†	\$2,229, \$1,800	\$4,899, \$4,100	\$9,549, N/A†
Base/maximum/tested RAM (MB)	12, 64, 24	4, 66, 12	24, 32, 24	6, 64, 38	3, 19, 7	6, 52, 6	12, 76, 12	12, 76, 12
Base/highest resolution (dpi)	600, 600	600, 600	400, 400	600, 1,200	600, 600	600, 600	600, 600	600, 600
Printer-engine manufacturer	Fuji/Xerox	Brother	Hitachi	Fuji/Xerox	Sharp	Canon	Canon	Canon
Processor speed and type	30-MHz RISC	20-MHz RISC	33/16-MHz RISC	50-MHz RISC	20-MHz RISC	33-MHz RISC	40-MHz RISC	40-MHz RISC
Highest PCL/Adobe PostScript supported	PCL 5/Level 2	PCL 5e/Level 2	PCL 5/Level 2	PCL 5e/Level 2	PCL 5e/Level 2	PCL 6/Level 2	PCL 5e/Level 2	PCL 5e/Level 2
PostScript emulation supplier	Adobe	Brother	Xionics	Adobe	Adobe	Adobe	Adobe	Adobe
Drivers and Software								
Drivers available:								
Windows 95: 16-bit/32-bit	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Windows 3.x/Windows NT	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
OS/2 Warp, Mac OS, Unix	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Printer management utility	Apple Printer Utility	NI Manage	PrintWatch	DSP	PrintSet	HP JetAdmin	HP JetAdmin	HP JetAdmin
Platforms supported:								
NetWare 3.12/NetWare 4.x/Windows NT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
OS/2, Mac OS, Unix	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Remote messages supported:								
On-line status/Paper sizes loaded	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Paper jam/Paper out/Paper low	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Toner out/Toner low/Usage tracking	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Web-based administration utility	■	■	■	■	■	■	■	■
Paper Handling								
Rated duty cycle (pages per month)	35,000	10,000	300,000	50,000	10,000	35,000	100,000	100,000
Standard paper inputs (total sheets)	3 (830)	2 (650)	3 (2,500)	3 (1,350)	2 (500)	2 (350)	3 (1,100)	4 (3,100)
Prints on legal-size paper/envelopes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Prints on tabloid-size paper (11" x 17")	■	■	■	■	■	■	■	■
Heaviest paper stock accepted	50 lb.	36 lb.	42 lb.	50 lb.	34 lb.	36 lb.	28 lb.	28 lb.
High-volume paper cassette capacity/list price	500 sheets/ Included	500 sheets/\$329	500 sheets/\$995	500 sheets/\$299	N/A†	500 sheets/\$299	2,000 sheets/ \$1,299	2,000 sheets/ Included
Duplexer	Included	\$549 (list)	Included	\$299 (list)	N/A†	\$679 (list)	\$669 (list)	Included
Sorter	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	\$1,889 (list)	Included
Lockable mailbox	N/A†	N/A†	N/A†	\$1,199 (list)	N/A†	N/A†	N/A†	N/A†
Stapler	N/A†	N/A†	N/A†	N/A†	N/A†	N/A†	\$2,665 (list)	Included
Hard disk capacity/list price	N/A†	Third-party	540MB/Included	125MB/\$600	N/A†	N/A†	420MB/\$499	420MB/Included
Rated toner cartridge life (at 5% coverage)	6,000 pages	6,000 pages	35,000 pages	10,000 pages	1,500 pages*	6,800 pages	15,000 pages	15,000 pages
Estimated cost per page (at 5% coverage)	2 cents	2.5 cents	0.02 cents	2 cents	2.5 cents	2.3 cents	1.7 cents	1.7 cents
Networking Support								
Standard/bidirectional/C-size parallel port	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
EPP/ECF	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Serial/SCSI/LocalTalk port	■ ■ ■	■ ■ □	■ ■ ■	■ ■ ■	□ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Supports more than one installed network adapter	■	■	■	■	■	■	■	■
Type of Ethernet connector	10Base-T, 10Base2	10Base-T, 10Base2	10Base-T, 10Base2	10Base-T, 10Base2	10Base-T	10Base-T	10Base-T	10Base-T
Card supports IPX/SPX, TCP/IP	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Card supports NetBIOS/NetBEUI/EtherTalk	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Other protocols supported	None	None	CCITT, Del LAT+D4	None	None	Sun OS	Sun OS	Sun OS
Supports automatic interface switching	■	■	■	■	■	■	■	■
Service and Support								
Toll-free technical support	■	■	■	■	■	■	■	■
Warranty (parts and labor)	1 year	1 year	90 days on-site	1 year on-site	1 year	1 year	1 year	1 year
Web address	www.imaging. apple.com	www.brother. com	www.dpc.com	www.printers. digital.com	www.genicom. com	www.hp.com	www.hp.com	www.hp.com

N/A†—Not applicable: The vendor does not cite a street price. N/A‡—Not applicable: The product does not offer this feature. * The vendor calculates cartridge life at 4% page coverage.

Network Printers

of jobs with calls to several trays to its mailbox bin. The stapler's special cube of 2,000 pins forms into staples on demand. The unit handled our custom orders with ease, producing the same clean originals as the LaserJet 5Si MX. It was slower (but not alarmingly so) than the other 24-ppm players on our Multiple Simultaneous Jobs test, producing 17.1 ppm. The Mopier is a serious contender for demanding departmental applications.

The workhorse of the Hewlett-Packard family is the HP's 5000 D640. Like the Typhoon 40 and the QMS 4060, this 600-dpi 40-ppm printer is meant for high-volume printing. About the size of a standalone office copier, the D640 sports a slick backlit LCD panel that displays a graphical representation of the printer and notes paper position and jams. The unit packs an 840MB hard disk containing 56 font cartridges, three 500-sheet paper trays, plus PCL 5e and HPGL/2 support.

The optional high-capacity input bin (\$3,785 list) and output bin (\$3,995 list) bring the total paper handling levels to 4,500 sheets of input and 2,400 sheets of output. An upgrade to PostScript Level 2 (and the extra 16MB of RAM you'll need) lists for \$1,995, and Windows 95 and Windows NT drivers are pending. While you can use the LaserJet 5Si's PostScript driver, you can print only text and not advanced graphics.

Setup required some extra effort. The original set of manuals contained solid information on the hardware, but lacked any instructions for connecting the printer to the network. When we inquired, HP sent us an updated version that was better. If you prefer, HP will send a technician to your site to provide setup and basic training for \$400.

Major concerns with any high-volume printer are ruggedness and ease of maintenance, and these are the areas where the HP 5000 D640 shows its elegance. The front door is molded to prevent it being closed unless all levers and parts are in the proper orientation. Paper jams are usually cleared with a turn of the advance knob, and if not, the LED panel displayed the exact location of the problem.

On our benchmark test suite, the D640 beat out the other 40-ppm units on the 50-page Duplex and 12-page Text tests. However, it lost ground when printing

multiple copies, taking 5 minutes to complete the Multiple Simultaneous Jobs test. This translates to a throughput of about 12 ppm versus 19.4 ppm for the Typhoon 40 and 33.6 ppm for the QMS 4060.

The HP 5000 D640 is a solid printer, well suited to high volume and economical operation. Lack of Windows 95 and Windows NT drivers may leave some users out, however. —JK

HP LaserJet 5M. Street price: Basic configuration (as tested), \$1,800. **HP LaserJet 5Si MX.** Street price: Basic configuration (as tested), \$4,100. **HP LaserJet 5Si Mopier.** List price: Basic configuration (as tested), \$9,549. **HP 5000 D640.** List price: Basic configuration, \$14,995; tested configuration, \$25,669. Hewlett Packard Co. Santa Clara, CA; 800-752-0900, 208-323-2551; www.hp.com. *Circle 461 on reader service card.*

IBM PRINTING SYSTEMS CO.

**IBM Network Printer 12,
IBM Network Printer 17,
IBM Network Printer 24**

After spinning off its Lexmark printer division and honoring a five-year non-compete agreement, IBM is back in the network printer business with three impressive 600-dpi workgroup units. The 12-ppm IBM Network Printer 12 (\$1,250 street), the 17-ppm IBM Network Printer 17 (\$1,750 street), and the 24-ppm IBM Network Printer 24 (\$3,430 street) are some of the most aggressively priced printers in their classes, even after you add the Ethernet adapter (\$399 list). Each delivers superb print quality as well as excellent administration utilities and paper handling options.

Setup for each printer was a breeze. Windows 3.11 and Windows 95 clients use Adobe's setup utility and drivers for both PCL and PostScript emulation. Windows NT clients use Microsoft drivers, and OS/2 Warp clients use IBM drivers.

To connect to the network we used NetWare's PConsole. The printers benefit from Network Printer Manager (NPM), IBM's robust administration software for installing and configuring the printers and viewing printer status. NPM also supports remote configuration and management using IBM Net-View, HP OpenView, or Novell's Managewise management platforms. The only drawback to

Continues		
HP 5000 D640	IBM Network Printer 12	IBM Network Printer 17
40 ppm	12 ppm	17 ppm
\$14,995, N/A†	\$1,599, \$1,250	\$1,999, \$1,750
\$349	\$399	\$399
\$25,669, N/A†	\$2,505, \$2,000	\$3,404, \$2,730
16, 64, 32	4, 66, 10	4, 66, 10
600, 600	600, 600	600, 600
Fujitsu	Fuji/Xerox	Fuji/Xerox
33-MHz RISC	33-MHz RISC	33-MHz RISC
PCL 5e/Level 2	PCL 5e/Level 2	PCL 5e/Level 2
PipeLine	Adobe	Adobe
 HP JetAdmin	 IBM NPM	 IBM NPM
  	  	  
300,000	35,000	65,000
3 (1,500)	2 (330)	2 (350)
		
36 lb.	28 lb.	28 lb.
2,000 sheets/\$3,995	500 sheets/\$269	500 sheets/\$349
Included	\$449 (list)	\$399 (list)
N/A‡	N/A‡	\$399 (list)
N/A‡	N/A‡	\$1,249 (list)
N/A‡	N/A‡	N/A‡
840MB/Included	810MB/\$559	810MB/\$559
18,000 pages	6,000 pages	10,000 pages
1.1 cents	2.7 cents	2 cents
  	  	  
10Base-T	10Base-T, 10Base2	10Base-T, 10Base2
 	 	 
Sun OS	TokenTalk	TokenTalk
		
90 days on-site	1 year	1 year
www.hp.com	www.printers.ibm.com	www.printers.ibm.com

Don't buy these three letters.

MMX



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generation of multimedia performance. In short, the AMD-K6 MMX processor is the most awesome engine ever built for running Microsoft Windows®-based PCs. Use one and it will leave you with this three-letter reaction: Wow. See for yourself and visit our website for the latest performance benchmarks or call 1-800-222-9323.



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SUMMARY OF FEATURES

Network Printers

PC MAGAZINE
EDITOR'S CHOICE

PC MAGAZINE
EDITOR'S CHOICE

PC MAGAZINE
EDITOR'S CHOICE

■ YES ■ NO □ OPTIONAL

In alphabetical order by company

	IBM Network Printer 24	Kyocera FS-1700	Kyocera FS-3700	Lexmark Optra S 1250	Lexmark Optra S 1650	Lexmark Optra N 245	Okidata Okipage 16n	QMS 2060 EX
Rated engine speed	24 ppm	12 ppm	18 ppm	12 ppm	16 ppm	24 ppm	16 ppm	20 ppm
List/street price, basic configuration	\$4,277, \$3,430	\$1,625, N/A†	\$2,395, N/A†	\$1,299, \$1,140	\$1,549, \$1,300	\$3,999, \$3,330	\$1,299, \$1,000	\$5,999, N/A†
List price of Ethernet adapter	\$399	\$429	\$429	\$499	\$499	\$310	\$479	Included
List/street price, tested configuration	\$5,521, \$4,420	\$1,625, N/A†	\$4,725, N/A†	\$1,997, \$1,700	\$2,247, \$1,850	\$3,999, \$3,330	\$2,615, \$2,000	\$5,999, N/A†
Base/maximum/tested RAM (MB)	12, 68, 12	2, 66, 2	2, 66, 10	4, 68, 16	4, 132, 16	16, 64, 16	2, 66, 18	48, 128, 48
Base/highest resolution (dpi)	600, 600	600, 600	600, 600	300, 1,200	300, 1,200	600, 1,200	600, 1,200	1,200, 1,200
Printer-engine manufacturer	Canon	Kyocera	Kyocera	Lexmark	Lexmark	Canon	Okidata	Minolta
Processor speed and type	66-MHz RISC	66/33-MHz RISC	66/33-MHz RISC	33-MHz RISC	66-MHz RISC	50-MHz RISC	32-MHz RISC	100-MHz RISC
Highest PCL/Adobe PostScript supported	PCL 5e/Level 2	PCL 5e/Level 2	PCL 5e/Level 2	PCL 6/Level 2	PCL 6/Level 2	PCL 5/Level 2	PCL 5e/Level 2	PCL 5e/Level 2
PostScript emulation supplier	Adobe	Kyocera	Kyocera	Lexmark	Lexmark	Lexmark	Adobe	QMS
Drivers and Software								
Drivers available:								
Windows 95: 16-bit/32-bit	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Windows 3.x/Windows NT	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
OS/2 Warp, Mac OS, Unix	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Printer management utility	IBM NPM	PrintMonitor	PrintMonitor	MarkVision	MarkVision	MarkVision	OkiView, OkiLAN	Crown Admin
Platforms supported:								
NetWare 3.12/NetWare 4.x/Windows NT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
OS/2, Mac OS, Unix	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Remote messages supported:								
On-line status/Paper sizes loaded	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Paper jam/Paper out/Paper low	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Toner out/Toner low/Usage tracking	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Web-based administration utility	■	■	■	■	■	■	■	■
Paper Handling								
Rated duty cycle (pages per month)	100,000	25,000	50,000	35,000	65,000	100,000	24,000	50,000
Standard paper inputs (total sheets)	3 (1,100)	2 (350)	2 (350)	2 (350)	2 (350)	3 (1,100)	2 (600)	2 (400)
Prints on legal-size paper/envelopes	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Prints on tabloid-size paper (11" x 17")	■	■	■	■	■	■	■	■
Heaviest paper stock accepted	30 lb.	56 lb.	56 lb.	125 lb.	125 lb.	36 lb.	32 lb.	42 lb.
High-volume paper cassette capacity/list price	2,000 sheets/ \$1,199	500 sheets/\$365	500 sheets/\$365	2,000 sheets/ \$1,099	2,000 sheets/ \$1,099	2,000 sheets/ \$1,299	500 sheets/\$299	500 sheets/\$399
Duplexer	\$569 (list)	\$685 (list)	\$685 (list)	\$629 (list)	\$629 (list)	\$669 (list)	N/A‡	\$499 (list)
Sorter	\$1,699 (list)	\$2,135 (list)	\$2,135 (list)	\$2,499 (list)	\$2,499 (list)	\$1,849 (list)	N/A‡	N/A‡
Lockable mailbox	N/A‡	N/A‡	N/A‡	N/A‡	N/A‡	N/A‡	N/A‡	\$99 (list)
Stapler	In sorter	N/A‡	N/A‡	In sorter	In sorter	In sorter	N/A‡	N/A‡
Hard disk capacity/list price	810MB/\$559	N/A‡	N/A‡	840MB/\$499	840MB/\$499	100MB/\$799	N/A‡	540MB/\$799
Rated toner cartridge life (at 5% coverage)	15,000 pages	15,000 pages	15,000 pages	7,500 pages	7,500 pages	15,000 pages	5,000 pages	10,000 pages
Estimated cost per page (at 5% coverage)	1.7 cents	0.5 cents	0.6 cents	2.8 cents	2.8 cents	1.7 cents	2.4 cents	2.3 cents
Networking Support								
Standard/bidirectional/C-size parallel port	□ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
EPP/ECP	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Serial/SCSI/LocalTalk port	■ ■ ■	■ ■ □	■ ■ □	■ ■ ■	■ ■ ■	■ ■ ■	□ ■ ■	■ ■ ■
Supports more than one installed network adapter	■	■	■	■	■	■	■	■
Type of Ethernet connector	10Base-T, 10Base2	10Base-T, 10Base2	10Base-T, 10Base2	100Base-TX, 10Base-T	100Base-TX, 10Base-T	10Base-T	10Base-T, 10Base2	10Base-T
Card supports IPX/SPX, TCP/IP	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Card supports NetBIOS/NetBEUI/EtherTalk	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Other protocols supported	TokenTalk	None	None	TokenTalk	TokenTalk	TokenTalk	None	IBM IPDS, Xerox XES/JDK
Supports automatic interface switching	■	■	■	■	■	■	■	■
Service and Support								
Toll-free technical-support	■	■	■	■	■	■	■	■
Warranty (parts and labor)	1 year	1 year	1 year	1 year on-site	1 year on-site	1 year on-site	1 year on-site	1 year on-site
Web address	www.printers .ibm.com	www.kyocera .com/printers	www.kyocera .com/printers	www.lexmark .com	www.lexmark .com	www.lexmark .com	www.okidata .com	www.qms.com

N/A†—Not applicable: The vendor does not cite a street price. N/A‡—Not applicable: The product does not offer this feature. * The vendor calculates cartridge life at 4% page coverage.

JUNE 10, 1997 PC MAGAZINE **209**

HARDWARE

Network Printers



Kyocera's FS line delivers cost-effective printing and moderate performance.

page is 2 cents. The current administration software has its weak spots (a much improved, 32-bit version should be released shortly), and the units were slow in producing documents that combined text and large graphics.

The units share the same compact footprint, and the modular design lets you add paper-handling options more easily than other printers we tested. Each option simply mounts on top of the last without screws or connectors. We added paper trays, a duplexer, and a sorter in minutes.

Network installation was quick, albeit unsophisticated. We had to rely on NetWare's PConsole to create the network print server and queue objects—functions other units support by more advanced software. Kyocera's administration software, PrintMonitor, provides basic management facilities under both TCP/IP or IPX. Although it lets you check remote printer status and modify settings, PrintMonitor lacks adequate security and more advanced features, such as alert filtering. The software allows you to group printers into public and private communities—public permitting read-only access, and private letting you modify printer settings. But there is no way to prevent users from changing a printer's community. PrintMonitor's upcoming 32-bit version will include beefed-up security features, alert filtering, and a network search feature that lets you determine which printer is best-suited to a particular print job.

The FS-1700 and FS-3700 both use Kyocera's long-life drum technology, which delivers a significant cost savings over the

printer's lifetime. The drum is made of an amorphous-silicon that is much harder than traditional OPC drums. Its special toner, Ecotone, continually polishes and preserves the drum. The result is a drum rated at 300,000 pages, during which time you need only add toner. These units also target vertical market applications that exploit Kyocera's Type I PC Card slots, PreScript II vector graphics language, and FormCard PC card for producing multi-part forms while reducing network traffic.

Our testing proved these units print plain text much faster than combined text-and-graphics documents. The FS-1700 beat out the HP LaserJet 5M on our 12-page Text test, but it turned in a disappointing 3.8 ppm on our Multiple Simultaneous Jobs test. The 18-ppm FS-3700 performed in the same way; it beat out the 17- and 20-ppm printers on text-only output, but it lagged behind even the 12-ppm on the Multiple Simultaneous Jobs test—with a dismal 5.0 ppm showing. At default settings, the Kyocera printers produced somewhat dark test images, which we were able to improve by tweaking the driver's intensity setting.

These Kyocera models offer cost-effective printing solutions for workgroups where moderate performance will suffice.—*Stephen W. Plain*

Kyocera FS-1700. List price: Basic configuration (as tested), \$1,625. **Kyocera FS-3700.** List price: Basic configuration (as tested), \$2,395. Kyocera Electronics Inc., Somerset, NJ; 800-232-6797, 908-560-3400; www.kyocera.com/printers. Circle 463 on reader service card.

LEXMARK INTERNATIONAL INC.

**Lexmark Optra N 245,
Lexmark Optra S 1250,
Lexmark Optra S 1650**



Sometimes you have to look past the market leader to find an exceptional product that is also an exceptional value. We reviewed Lexmark International's new generation of 1,200-dpi letter- and legal-size workgroup printers, the 12-ppm Lexmark Optra S 1250 (street \$1,140; not including the Ethernet adapter—\$499 list)

and the 16-ppm Lexmark Optra S 1650 (street \$1,300; not including the Ethernet adapter—\$499 list). We also tested the higher-end 24-ppm Lexmark Optra N 245 (\$3,330 street; Ethernet adapter, \$310), a tabloid-size (11- by 17-inch) printer suited for departmental printing. (The Optra S 2450 25-ppm printer was not ready at the time of this review). All three printers deliver exceptional print quality, easy setup and administration, robust features, and class-leading performance.

Setting up these printers was simple. The modular, stackable design of the paper trays, output bins, duplexers, and other components made it easy to make



You can't do better than these Lexmark Optra printers, all Editors' Choice winners.

adjustments and add options. We especially liked the universal paper tray, which can be adjusted to suit smaller custom media as well as conventional sizes. Another convenience is the intuitive four-line LCD panel, which makes it easy to check job and printer status at the units.

Lexmark's MarkVision administration software provided some of the most extensive network configuration, monitoring, and support we've seen in this roundup. MarkVision's Novell NDS and bindery management and support was unmatched. It can create, monitor, and configure printers, print servers, and print queues without using NetWare's PConsole. MarkVision also offers job statistics, paper- and toner-level meters, and alerts. We especially liked the network installation of MarkVision, which can automatically update workstation driver versions.

The TCP/IP support was strong, offering Windows NT DHCP, WINS, and man-



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Workgroup multifunction printers

By Winn L. Rosch

Network printers are vying to be your office copier as well. So why not consider a copier that can serve as your network printer? These ingenious machines—which can combine network printer, copier, fax, and scanner into a single package—conserve valuable office space and offer the convenience of centralized maintenance and operation. Moreover, the cost of a multifunction unit is 10 to 15 percent less than the total cost of these units purchased individually.

Such benefits have lured many major office-equipment makers—including Canon, Konica, Ricoh, and Xerox—into the workgroup multifunction market. We examined the second-generation Canon GP200F, our choice based on Canon's leadership in print-engine design and manufacture.

Canon is first and foremost a copier company; the GP200 (\$5,995 list) is, at its core, a 20-ppm, full-duplex, tabloid digital copier. You can add features piecemeal or buy the fully loaded GP200F (\$18,200), which includes a network interface card, PostScript and PCL5e print controller, fax controller card, and scanning board and software.

We tested the GP200F. Based on a 600-dpi CCD scanner and matching print engine, it enlarges (to 800 percent, in 1-percent increments) or reduces (to 25 percent) tabloid images. It delivers 600-dpi print resolution at near its rated 20-ppm speed. Canon's rapid-fusing technology eliminates warm-up waits; the first sheet takes only about 9 seconds to print. Subsequent sheets follow at engine speed.

Paper is handled via two 500-sheet paper trays that hold up to 11- by 17-inch sheets, and a 50-sheet bypass tray for envelopes and smaller media. The Cassette Feeding Unit (\$2,000), which contains four 500-sheet trays, offers additional capacity. The GP200F lets you select an input tray for each job or switch trays during a job. For collating and stapling capability, a Multi-Output Tray (\$2,200) adds 12 bins to sort, collate, separate, and staple output.

We were impressed by the way the GP200F prioritized various types of jobs. The default configuration gives copying priority over computer printing and will temporarily interrupt print jobs during a copy job. Fax scanning and sending is separate from printing, so both faxing and printing can occur simultaneously. If a fax job is sent over the network while someone is copying, the fax job will spool to memory and continue after the copy job is done.

For faxing, the GP200F scans pages into memory and transmits them unattended. Our 12-page fax took only 34 seconds, using the Recirculating Document Feeder

(\$1,900), which restacks up to 50 pages in their original order. The fax system also operates as a PC-to-fax system across the network.

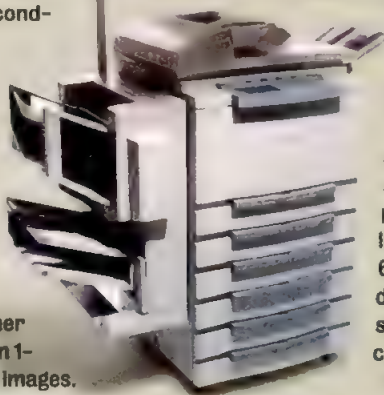
The GP200F is weakest as a stand-alone scanner. Although commendably fast (it scans a full letterhead page in 3 seconds), the scanner is limited to 8-bit, gray-scale scans at 600 dpi. Oddly, it follows the ISIS standard instead of the Twain, requires a separate SCSI connection, and can't be controlled through the network.

With any combination unit, vulnerability is a big concern; a single failure can put your company or workgroup out of action. Although the GP200F's modules include separate processors and memory, many critical components are shared, such as a common fax and copy scanner, print engine, paper-feed system, and power supply.

Although these concerns made us a little wary of the Canon GP200F, by the time we finished testing, its quality and smooth operation won us over.

Canon GP200F. List price: \$18,200. Canon U.S.A. Inc., Lake Success, NY; 800-652-2666, 516-328-5000; www.usa.canon.com.

Circle 457 on reader service card.



ual IP address configuration. The printer can even act as an HTTP server, giving the administrator access (through a Web browser) to network configuration settings and direct links to Lexmark's Web site for updates and support for the specific printer. Lexmark's Web-based management utility should be available soon after you read this for \$299 per server.

With the exception of the HP LaserJet 5M, the Optra S printers were the only units we tested to support PCL 6. The Optra S printers distinguished themselves by offering true 1,200-dpi print engines, which produced exceptionally high-quality output. The Optra S printers were also

remarkably quiet while printing.

To assure that the network port is not a bottleneck for achieving optimal performance, Lexmark includes its 10/100-BaseT PCI MarkNet network interface cards on the Optra S 1250 and the Optra S 1650. Indeed, the Optra S models proved to be excellent performers, taking top scores on nearly all our tests. The Optra S 1250 produced 11.8 ppm on our Multiple Simultaneous Jobs test, virtually tied with the LaserJet 5M. The Optra S 1650 completed the 50-page Duplex test a full 52 seconds ahead of the IBM Network Printer 17, and produced 15.1 ppm on the Multiple Simultaneous Jobs test. We were also

impressed by the printers' ability to concurrently process multiple jobs from the print queue, continuously receiving image and print data without missing a beat.

The 24-ppm Optra N is an exceptional value for a high-end, tabloid-capable network printer. Getting the Optra N up and running on the network was amazingly simple, thanks to MarkVision software, which set up the Novell print queues and brought the printer online without a hitch.

The Optra N matches the HP LaserJet 5Si MX's paper-handling capabilities, but the duplexer's modular design made for an effortless installation. We simply slid in the unit without any disassembly or



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HARDWARE

Network Printers

connections. Like its siblings, the Optra N was the leader in its class on nearly all our performance tests, and produced an impressive 22.2 ppm on our Multiple Simultaneous Jobs test. The Optra N's image quality was excellent. The graphics were well balanced and precise, and Lexmark's text-enhancement technology, PQET, produced characters that were smooth and crisp. Also provided by the printer driver was software-interpolated 1200-dpi "image quality," which allowed the printer to perform closer to rated printer speed.

The features, functionality, and performance of the Lexmark Optra N 245, the Lexmark Optra S 1250, and the Lexmark Optra S 1650 prove all three models to be real winners.—*Stephen W. Plain and Denis Tom*

Lexmark Optra N 245. Street price: Basic configuration (as tested), \$3,330. **Lexmark Optra S 1250.** Street price: Basic configuration, \$1,135; tested configuration, \$1,695. **Lexmark Optra S 1650.** Street price: Basic configuration, \$1,300; tested configuration, \$1,855. Lexmark International Inc., Lexington, KY; 800-539-6275, 606-232-2000; www.lexmark.com. *Circle 464 on reader service card.*

OKIDATA

Okipage 16n

Okidata addresses the medium-size workgroup market with the 16-ppm, letter- and legal-size Okidata Okipage 16n (\$1000 street; not including the Ethernet adapter—\$479 list). The Okipage produces excellent text and graphics output. But don't let the low price fool you: Network and PostScript support cost extra, and the documentation and network management and support tools are well below par.

Setup for IP was difficult; the manual lacked instructions for installing the printer on a Windows NT 4.0 network for any type of printing. We finally found a page detailing IP setup with DOS-based OkiLAN utilities—in the *Unix* section of the manual. For networks that are completely Windows NT-based, you must install both SAP Services for Windows NT and Gateway Services for NetWare in order for the OkiLAN utilities to run. Knowledge of how to set up an LPR port

under Windows NT is also helpful. While the Okipage is a multiprotocol printer, it failed our Protocol Switching test: When we sent jobs to both the IPX and IP queues, the Okipage always printed the IPX jobs first, rather than interleaving them as we feel a true multiprotocol printer should.

The Okipage ships with OkiView, the Windows printer management utility. We used OkiView to configure the Okipage and hook the printer up to our NetWare network, but OkiView lacks both NDS and TCP/IP configuration support. OkiView displays rudimentary printer status information on paper jams and paper outages, and while the manual and READ.ME files claim the program can track print jobs, we could not enable the feature.



The Okipage 16n's price and print quality may tempt, but setup isn't for the weakhearted.

With Okidata's Oki Smoothing resolution-enhancement technology, the printer's standard 600-dpi resolution can be extended to 1,200 dpi. Text was crisp and graphics showed fine detail. Not that PCL output far outclassed PostScript, because Oki Smoothing is built into the PCL print drivers. When compared with other 16- and 17-ppm contenders, the Okipage's performance was acceptable, though not outstanding. It produced 12.9 ppm on our Multiple Simultaneous Jobs test.

If you can forgive the setup and administration headaches, the Okidata Okipage 16n's excellent text and graphics output are tough to overlook for the price.—*SK*
Okipage 16n. Street price: Basic configuration, \$1,000; tested configuration, \$2,000. Okidata, Mt. Laurel, NJ; 800-654-3282, 619-235-2600; www.okidata.com. *Circle 465 on reader service card.*

QMS INC.

QMS 2060 EX,
QMS 2425 EX,
QMS 4060



QMS continues its assault on the printer market with these heavy-duty printers. The 20-ppm, 1,200-dpi, tabloid QMS 2060 EX (\$5,999 list, including the Ethernet adapter) is for midsize workgroups. For departmental use is the 24-ppm, tabloid QMS 2425 EX (\$5,499, including the adapter), which garnered an Editors' Choice last year for its powerful performance and robust paper handling. We also tested QMS's big gun, the new 40-ppm, 600-dpi QMS 4060 (\$19,999, including the adapter), which has powerful paper-handling and mopying features for enterprise-wide applications. QMS's unsurpassed networking savvy and enhancements make these printers some of the best on the market.

Each printer includes QMS's CrownNet multiprotocol network Ethernet card and driver support for NetWare, Microsoft LAN Manager, OS/2 LAN Server (NetBIOS/NetBEUI), and TCP/IP. QMS designs its printers around its excellent Crown multitasking software, which provides the intelligence required for the printer to perform simultaneous operations (such as rasterizing images in the printer while receiving data from the NIC), and support auto-switching emulation and other printing features such as usage tracking (for billing or resource allocation). The administrator can assign how memory is allocated, and an installed hard disk can serve as virtual memory to accept incoming jobs.

In addition to the Crown multitasking software, QMS provides the CrownAdmin2 utility. Similar to HP's JetAdmin, CrownAdmin2 remotely configures and manages printers over the LAN. CrownAdmin2 can also receive printer status and send alerts to network managers in real time. And CrownAdmin2 provides a common interface across Windows and Unix platforms.

We had no setup problems using CrownAdmin2 and NetWare's PConsole. QMS has a strong set of Windows 95 drivers (which also support Windows NT) that provide print-queue and status information. An included Windows PrintMoni-



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EIZO NANAO WINS AGAIN!

Back To Back Nod For Monitor Maker

By **Fitz D. Loothun**
MONITOR STAFF WRITER

LOS ANGELES — It's an announcement that is becoming all too familiar. EIZO Nanao Technologies has once again taken home the coveted Editor's Choice Award from PC Magazine.

This sixth award in the past six years goes to the company's FlexScan® TX-C7S 17-inch class color monitor. It's an honor that carries particular significance as it cites superiority in the judging category having the toughest standards.

"The TX-C7S monitor's image was especially sharp and clear, with no detachable faults," said a PC Magazine judge.

Not too surprising for EIZO, though. The company's monitors previously earned Editor's Choice



**October 8, 1996
FlexScan TX-C7S**

accolades in 1990, 1992, 1993— for its FlexScan 9400, F550iW and FlexScan F340iW monitors—and last year for its highly regarded FlexScan T2-17TS model.

TX-C7S Lauded as 'Best of the Best'

By **E.Z. Vowin**
MONITOR STAFF WRITER

LOS ANGELES—Words such as "unbeatable," and "top flight," have been flying around town ever since EIZO Nanao's FlexScan TX-C7S 17-inch class color monitor walked off with the 1996 PC Magazine Editor's Choice Award.

With this key award under its belt, the FlexScan TX-C7S figures to be the monitor of choice for graphics and business professionals who demand crisp, true-to-life colors and stable screen images



This year's big winner: The FlexScan TX-C7S 17-inch class color monitor.

for desktop publishing, 24-bit imagery, high-end graphics and multimedia applications.

Editor's Choice: The Award That Shapes Industry Thinking



It's deja vu all over again: EIZO Nanao has now won six Editor's Choice Awards in six years.

By **Mona Turr**
MONITOR STAFF WRITER

LOS ANGELES—Winning a PC Magazine Editor's Choice Award tells the world of hungry hardware buyers that you've arrived in a big way.

"It's the one award we all dream about, the one we covet more than any other," said N.V.S. Guy of Silicon Valley's LuzerCom.

EIZO Nanao monitors have earned worldwide recognition for dependability, cost-effective performance and pleasing, ergonomic design. In fact, I'm going to stop writing this story right now so I can call EIZO Nanao Technologies at **1-800-800-5202**. Then again, I could get an informational fax on demand by calling **1-800-416-FLEX**. Either way, like the TX-C7S, I'm a winner.



EIZO is Nanao's New Universal Brand Name
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90630 Web Site: <http://www.eizo.co.jp/welcome>

Network Printers

tor lets you send jobs directly to the printer over TCP/IP networks, bypassing the file server to conserve network bandwidth.

For easy upgrades and feature additions, QMS incorporates its Software Loadable System technology into each printer. This lets administrators deliver enhancements and upgrades remotely over a network or via



Rock-solid design and networking make these QMS printers a force to reckon with.

a direct connection to the printer. The printers perform automatic emulation switching using QMS's Emulation Sensing Processor technology. Another welcome feature is jam recovery; the printers automatically reprint lost pages and continue with queued jobs.

These units fared well on our benchmark tests. The 20-ppm 2060 EX performed better than the 24-ppm HP LaserJet 5Si MX and IBM Network Printer 24 on the 12-page Text and Graphics test, and it beat all the 24-ppm contenders except the Lexmark Optra N on the Multiple Copies of Single Job test. On the Multiple Simultaneous Jobs test, its effective ppm throughput was an impressive 18.4. The 1200-dpi output was excellent.

Both the 2425 EX and the 4060 offer exceptional multiple original print (mopy) capabilities and printer-based collation, which significantly reduces network traffic when you select multiple prints. Both units also accept QMS's CrownCopy, a 300-dpi scanner (\$1,999). Connected via the printers' built-in SCSI ports, it handles bulky scans; an automatic document feeder feeds up to 50 sheets at a time.

The 2425 EX was less impressive than the 2060 EX on our benchmark tests, though generally only a few seconds sep-

arated it from the leader on any particular task. Its effective throughput of 18.8 ppm on our Multiple Simultaneous Jobs test placed it in the middle of the 24-ppm pack. Its 600-dpi output will suit any user.

If you need a serious workhorse printer for high-volume corporate output, consider the 4060, meant to go up against the likes of the Dataproducts Typhoon 40 and HP 5000 D640. In addition to networking and mopy features, it boasts a 300,000-page-per-month duty cycle and standard 1,500-sheet input capacity, upgradeable to 4,500 sheets (\$3,799). The enhanced driver for the 4060 even lets you rotate printed pages by 90, 180, or 270 degrees.

The 4060 showed solid performance on our speed tests. Thanks to QMS's superior multijob capabilities, the 4060 produced an effective 33.6 ppm on our Multiple Simultaneous Jobs test, processing 5 jobs concurrently—well ahead of the Typhoon's 19.4 ppm and the D640's 12.0 ppm while processing just one job.

QMS consistently proves it knows how to deliver a top-shelf printer for every printing need. Every workgroup and department—large or small—will find QMS's snappy, high-quality printers an excellent addition to the network.—*PB*
QMS 2060 EX. List price (as tested): \$5,999.
QMS 2425 EX. List price (as tested): \$5,499.
QMS 4060. List price (as tested): \$19,999.
 QMS Inc. Mobile, AL; 800-523-2696, 334-633-4300; www.qms.com. Circle 466 on reader service card.

XEROX CORP.

DocuPrint 4512

The Xerox DocuPrint 4512 (\$1,270 street, \$379 list) will find a home in small workgroups where value is paramount. This compact, letter- and legal-size, 600-dpi unit has a generous 500-sheet total capacity and is one of only two 12-ppm units we tested to include a duplexer. (The other is the Apple LaserWriter 12/640 PS Plus, which costs substantially more.) The DocuPrint shaves operating costs further by using a toner cartridge rated for 15,000 pages (twice the amount of comparable units) and a separate photoconductor drum module that lasts for 30,000 pages. Xerox estimates cost per page at a fraction of a penny, versus 2 cents per page for other lasers.

Although we had no trouble setting up the printer using NetWare's PConsole, the unit lacked any elegant setup routines (à la HP's JetAdmin) to facilitate the task. Xerox's new wizard-based administration software, CentreWare, should be out by the time you read this. A Web-based version should also be available, which will let MIS professionals check and configure the printer from any browser-equipped PC.

The DocuPrint features automatic jam recovery to reprint any pages lost in a jam. The envelope tray holds a mere 20 envelopes, but it functioned smoothly, delivering clean addresses. The printer failed our Protocol Switching test, processing groups of jobs not by order of arrival in



Cost-conscious small workgroups will appreciate the DocuPrint's built-in duplexer.

the print queues but servicing IPX jobs before those sent over TCP/IP. This preference probably won't affect a small single-server workgroup, however.

This unit consistently placed in the lower half of the 12-ppm field on our tests, though its effective throughput of 8.1 ppm on our Multiple Simultaneous Jobs test is adequate for a small-workgroup printer. Image quality was on a par with other 600-dpi units. Our test graphic produced good tonal range under default settings, and the unit offers TrueRes enhancement.

The Xerox DocuPrint 4512 offers a good value for small networks looking for low cost of entry and unbeatable operating costs. And the built-in duplexer is a bonus hard to ignore. Once the advanced management software is complete, the DocuPrint will be an even sweeter deal.—*JK* □

Xerox DocuPrint 4512. Street price: Basic configuration, \$1,270; tested configuration, \$2,465. Xerox Corp., Rochester, NY; 800-349-3769, 716-383-2998; www.xerox.com. Circle 467 on reader service card.

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POWER PUBLISHING SOFTWARE



W W W W V

Windows Magazine

March 1997

Recommended Product!

"Ventura's definitely the program to beat now..."

"... if you're interested in a full DTP package, it's time to try Ventura 7."



★ ★ ★ ★ ★

PC Computing

November 1996

"Ventura Publisher 7.0 opens up a new market for itself, not merely as a large-document publisher, but as a temptingly easy-to-use, multipurpose publishing application... all in one package. It's a tough act to follow."



PC Week

November 25, 1996

"Corel Ventura 7 for Windows 95 and Windows NT is a smart upgrade as well as a good first-time purchase. The page layout program's strong Web-page design capabilities are a bonus and the bundling of Corel WordPerfect 7, Corel Database Publisher and Corel Photo-Point with Ventura 7 makes for a robust combination of desktop-publishing applications."



Windows Sources

October 1996

"Corel's Ventura 7 is rocketing to the top of the charts, thanks to a revamped interface and support for cutting-edge Web publishing."

"We were delighted with every facet of Ventura 7."



MacWeek, Seybold Show Daily

September 10, 1996

"... the new Corel-style interface offers more context-sensitive tool and palette selection than anything I've seen. Ventura is still strong on long documents, too, and the table-creation feature is hot."



★ ★ ★ ★ ★

Publish

March 1997

"Version 7 is a major programming achievement and has returned Ventura to the pantheon of professional layout software..."

"Corel Ventura 7 is significantly better than its forebears at creating short, design-intensive documents such as brochures, ads, and promotional pieces."

"Corel Ventura is back on my play list."



InfoWorld

July 15, 1996

"... the new Corel Ventura 7 currently offers the most alternative publishing options, and they are better-designed than those that you'll find elsewhere. Ventura 7 now equals and often surpasses the functionality of its competitors."



PC World

September 1996

"You can publish Java, Common Ground, and Envoy (Acrobat-like) documents. Java format, for example, lets you use pop-up windows, multiple fonts, and more in your online documents. Ventura 7 also comes with WordPerfect SGML so you can work with SGML documents or import them into Ventura 7. QuickTime movies? No sweat, Ventura does those too."



Home Office Computing

August 1996

"Considering the strength of Corel Ventura's DTP functions and the wealth of extras in the package, this is an affordable and powerful way to produce your own publications."



The Seybold Report on Desktop Publishing

August 12, 1996

"It is for those buying their first page composition program that Ventura 7 has the most appeal. The product has all of today's checklist features and lots of extras thrown in free."

"... Ventura is on its way back, and it's aiming at nothing less than to be at the top of the heap."

The verdict is in. Corel VENTURA™ 7 has leapt ahead of Adobe® PageMaker® and QuarkXPress™ for power publishing.

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PC Tech



VBScript 2.0 and JavaScript 1.2

Scripting is the key to interactive Web pages.

By William Robert Stanek

The Web is rapidly becoming a medium that rivals television for information content and entertainment value. A key technology driving the transformation of the Web from a land of lifeless, static pages to a realm with fully interactive resources is Web scripting. With Web scripting, you can create Web pages that react in real time as well as ones that are self-updating and self-validating.

If you want to create scripts for your Web pages, the two primary scripting languages you use are VBScript and JavaScript. Although VBScript is a streamlined version of Microsoft's popular Visual Basic programming language, it retains the ease of use and many of the powerful features that made Visual Basic so popular. Like VBScript, JavaScript is based on a programming language, in this case Java, the Web darling. Unlike VBScript, JavaScript

is completely object-based.

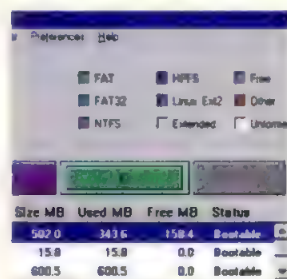
Both VBScript 2.0 and JavaScript 1.2 have strengths and weaknesses, and this makes choosing the right scripting language for your Web page or Web development project a challenge. To help you make your decision, we take a closer look at both, then follow up with specific comparisons including pointers on when to use VBScript or when to use JavaScript.

VBSCRIPT 2.0: AN INTRODUCTION

With Version 2.0, VBScript gains the functionality of a programming language while retaining the simplicity of a technology streamlined for the Web. Scripts are inserted directly into your Web pages and thus are loaded along with the HTML codes that describe the page.

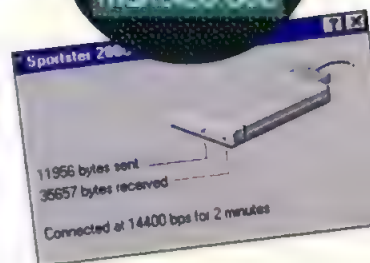
Since VBScript is a subset of Microsoft's Visual Basic, the scripts resemble VB programs. If you aren't a Visual Basic programmer, don't

INSIDE



TUTOR: Partitioning your hard disk can be frightening since it usually involves data loss. We show you why you might want to do it anyway. *Page 243.*

UTILITIES: BigBin ensures that files you delete under DOS windows will be sent to the recycle bin just as though you deleted them from Explorer. *Page 253.*



PC SOLUTIONS: Making icons for Windows 95; mixing gold and tin SIMMs; inserting links to other documents and URLs in Excel; and more. *Page 283.*

PC Tech Online
All files mentioned in this section are available online from our Web site at WWW.PCMAG.COM




```
<HTML>
<HEAD>
<TITLE>Controlling a Button With VBScript</TITLE>
</HEAD>

<BODY BGCOLOR="#FFFFFF">
<H1 ALIGN=CENTER>VBScript Demo</H1>

<P>With VBScript, you can dramatically boost the level
of interactivity in your Web pages. In VBScript, a simple
button becomes a gateway to everything your site has to
offer. At the press of a button, a dialog box can appear
to answer the question, offer advance, direct the user to
interesting areas of the site or simply to perform a
calculation based on entries in an HTML form.</P>

<INPUT TYPE=BUTTON NAME=aButton VALUE="Don't Push This Button!">

<SCRIPT LANGUAGE="VBScript">
<!--

' This procedure is executed whenever the button labeled aButton is clicked
Sub aButton_OnClick

    MsgBox "Why did you click the button? Did you read the label?"

End Sub

-->
</SCRIPT>

</BODY>
</HTML>
```

FIGURE 1: A button controlled with VBScript.

worry. Many Web publishers who aren't Visual Basic programmers use VBScript to enhance their Web pages because VBScript is so easy to use.

In its original form, Visual Basic was not well suited to the Web, mainly because of the massive overhead associated with VB programs. Thus, when the developers at Microsoft redesigned Visual Basic for the Web, they knew they had to streamline every aspect and keep only the essential elements of the language.

The developers also knew that security is a major issue in all Web technologies and that a scripting language that opens the end user's system to attack and compromise will not succeed. To protect computer systems from attacks, VBScript enforces a strict security model.

VBScript is an interpreted scripting language. That means that you do not need to compile your scripts. Your scripts are directly interpreted line by line when they are executed in the user's browser. The browser component interpreting the script is the VBScript interpreter.

FEATURES

Most books and articles covering VBScript discuss Version 1. If you haven't tried VBScript 2.0, you don't know what you are missing. VBScript 2.0 is rich in features, yet maintains the lightweight structure and ease of use that made the original so attractive to Web developers.

With VBScript 2.0, Web developers gain more functionality in every area, including more direct support for Microsoft's flagship ActiveX technology and for the Active Platform. There is even a server-side scripting module for Microsoft's Active Servers that includes the Internet Information Server versions 3.0 and later. Not only do these enhancements tightly integrate VBScript with both client-side and server-side functions, they make VBScript a key player in the future of the desktop. Case in point: VBScript is one of the showcase technologies working behind the scenes for the Active desktop of Windows 97.

The syntax and structure of VBScript are like comfortable shoes for anyone who has ever programmed before, especially when it comes to constants and functions, and VBScript supports many different types. There are constants for the eight basic colors, such as `vbRed` for the color red or `vbBlue` for the color blue. There are functions to obtain numeric values, such as `Abs`, which returns the absolute value of a number, and functions to work with dates, such as `Date`, which returns the current date and time.

Beyond the dozens of constants and functions are control structures and objects. Using conditional control structures such as `If ... Then ... Else`, you can control when sections of your scripts are executed and react to user-driven events. Although the original version of VBScript included only the `Err` object, VBScript 2.0 adds support for `Dictionary`, `FileSystem`, and `TextStream` objects. These new objects, which let you store data in value/pair arrays, work with the file system, and manipulate text files, show that VBScript will move increasingly toward an object-based paradigm. With object-oriented methodology come the increased flexibility and significant advantages of a modern approach to structured programming.

After you tinker with VBScript 2.0 for a while, you'll discover that it is ideally suited for working with strings, numbers, dates, and text-based files. In a way, this new version of VBScript steals the thunder from CGI scripts, which had been previously used to perform the data manipulation tasks that are now better supported in VBScript. In fact, VBScript 2.0 adapts techniques from Perl to enhance functionality in working with data. (If you've written CGI scripts in Perl, you know that its popularity is due largely to its advanced data manipulation capabilities.)

SCRIPTING WITH VBSCRIPT

The uses for VBScript in your Web pages are endless. You can use scripts to add interactive buttons and menus to your Web page. When the user makes a selection on a menu, portions of the page can change according to the selection. At the press of a button, a dialog box can

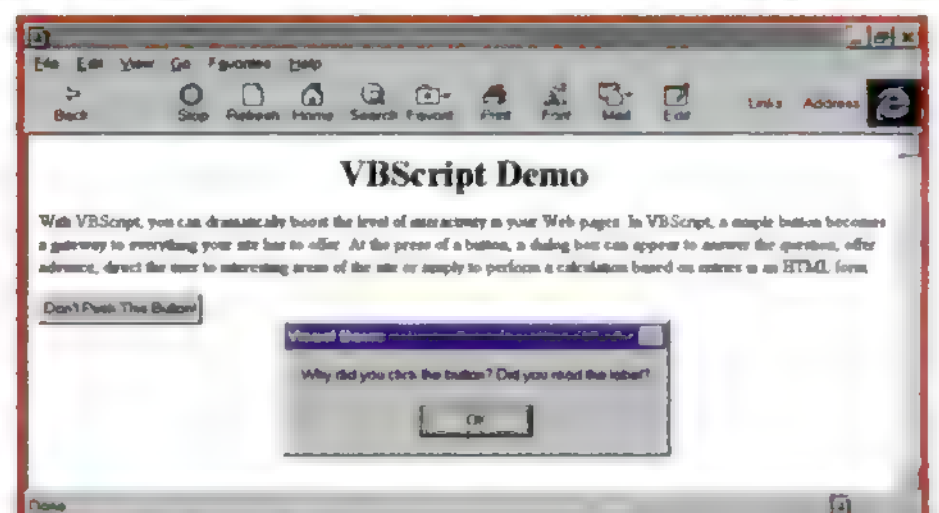


FIGURE 2: A button control that displays a dialog box.


```
<HTML>
<HEAD>
<TITLE>Handling On-line Orders With VBScript</TITLE>
</HEAD>

<BODY BGCOLOR="#FFFFFF">

<H1>The Order Center</H1>
<P>Place your order using our fill out form and you'll
receive your purchases within 2 weeks--We guarantee
it!</P>

<P><FONT SIZE=-2>Residents of Washington state must pay
an additional sales tax of 8%.</FONT></P>

<PRE>
    Number of books: <INPUT NAME="orderSize" SIZE=3
VALUE=1>
    State of residence: <INPUT NAME="resState" SIZE=2>
</PRE>

<P><B>
<INPUT TYPE=BUTTON VALUE="Place Book Order"
NAME="compCost">
</B></P>

<PRE>
    Sub Total                $<INPUT NAME="orderCost"
                              SIZE=10>
    Sales Tax (8% WA only)   $<INPUT NAME="orderTax"
                              SIZE=10>

    Total                    $<INPUT NAME="orderTotal"
                              SIZE=10>
</PRE>
<SCRIPT LANGUAGE="VBScript">
```

```
<!-- Option Explicit

Sub compCost_OnClick()

Dim State
Dim numBooks
Dim Cost
Dim Tax
Dim Total

numBooks = orderSize.Value
State = resState.Value

Cost = 19.95 * numBooks

If State = "WA" Then
    Tax = Cost * 0.08
Else
    Tax = 0
End If

Total = Cost + Tax

orderCost.Value = Cost
orderTax.Value = Round(Tax,2)
orderTotal.Value = Round(Total,2)

End Sub

-->
</SCRIPT>

</BODY>
</HTML>
```

FIGURE 3: Handling online orders with VBScript.

appear to answer the user's question, offer helpful hints, or show the results of a calculation.

VBScript can be used to create forms that change in response to users' questions. These customized forms can tailor orders, surveys, and technical support to the customer's specific needs. Results from VBScript-enhanced forms can be processed locally by the user's browser and then can be passed on to a server-side script for further processing.

Elements in Web pages that can be manipulated through VBScript are called *controls*. There are two types of controls: ActiveX controls and intrinsic controls. ActiveX controls are programmable objects that can be embedded in Web pages. *Intrinsic controls* are elements inherent in HTML, such as push buttons, text input fields, and check boxes.

Besides being the easiest type of control to add to your Web page, intrinsic controls can also be easily manipulated with VBScript. For example, you can add a push-button control to a Web page using the following line of HTML code:

```
<INPUT TYPE=BUTTON NAME=aButton
VALUE="Don't Push This Button!">
```

To display a dialog box when this button is clicked, you can use the following code:

```
Sub aButton_OnClick
    MsgBox "Why did you click the
button? Did you read the label?"
End Sub
```

By examining these code snippets, you can learn how VBScript works. The name of the button is `aButton`. All buttons have a related event called `OnClick`. When this button is clicked, the subroutine `aButton_OnClick` is automatically executed. VBScript features many additional ways to handle user events such as moving the mouse, detecting when the pointer is over an object, and determining when a control has lost focus. The `MsgBox` statement tells your browser to display a dialog box with the contents you define between the quotation marks.

Figure 1 shows the code for a Web page

that uses this button control. As you examine this listing, note the syntax used to add scripts to Web pages. Figure 2 shows this example running in Microsoft Internet Explorer.

As noted previously, VBScript is great for crunching numbers. Using it, you can easily create a script to handle online orders—a task traditionally handled with a server-side CGI script. By contrast, with CGI, the user has to fill out a form, submit it to a server, and then wait for the server to respond. After the server completes the calculations, the results are sent back to the client, which then displays the results.

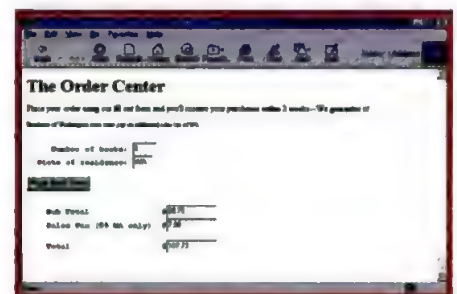


FIGURE 4: The online order screen.



VBScript eliminates all the back-and-forth processing between the client and the server. The user fills out an order form and sees the results instantly. To see how this could be handled, take a look at Figure 3. By examining the script, you can get a feel for how easy it is to perform complex tasks with VBScript. Figure 4 shows this example in action.

JAVASCRIPT 1.2: AN INTRODUCTION

JavaScript is a powerful and versatile scripting language designed exclusively for the World Wide Web. You can use it to transform lackluster Web pages into dynamic, fully interactive pages with real-time response. Best of all, JavaScript is easy to use.

Like VBScript, JavaScript continues to evolve as a Web scripting language. The most current implementation is Version 1.2. If you've been following JavaScript for a while, you know it was originally called LiveScript. Netscape began developing LiveScript as a client-side solution for adding scripts to Web pages and later changed the name to JavaScript to reflect the scripting language's development in concert with Sun Microsystems' Java programming language.

Because JavaScript is based in part on Java, it follows an object-based approach to Web

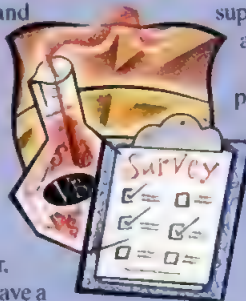
Browsing the Web with VBScript

A VBScript 1.0 interpreter is packaged with Microsoft Internet Explorer 3.0. If you want to gain the extended functionality and versatility of VBScript 2.0, you need to obtain Internet Explorer 4.0. You can download a trial version by visiting www.microsoft.com/ie/ie40.

Although a VBScript interpreter is part of Microsoft's Internet Explorer, most other browsers do not have a VBScript interpreter. But ScriptActive, a plug-in for Netscape Navigator 3.0/4.0 that supports VBScript, is available from NCompass. To obtain it for a free 30-day

trial, visit the NCompass Web site at www.ncompasslabs.com/scriptactive. A new version of the ScriptActive plug-in that supports VBScript 2.0 may be available by the time you read this.

Once you install the ScriptActive plug-in in Netscape Navigator, you will be able to view pages that contain scripts written in VBScript. If you use VBScript in your own Web site, you may want to include a link to the NCompass Web site on one of your top-level Web pages. By doing this, visitors to your site who use Netscape Navigator can obtain and install the plug-in before accessing VBScript-enhanced pages.



scripting, allowing you to work with custom functions and objects as well as built-in objects. These built-in objects feature components that let you implement advanced functions with a minimal amount of actual scripting.

Netscape also developed LiveWire, a server-side implementation of JavaScript which contains JavaScript objects specifically designed for server-side use. These objects allow you to perform tasks that only server-side plug-ins,

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Wake up and smell the **JAVA**: a new computing age has dawned



Nobody can afford to scrap their huge investments in existing information systems.



what's the answer?



As a quick way to publish and access information, there is nothing quite like the Internet. In just a couple of years, it's transformed the way most companies think about doing business, and for a few organizations, Internet-inspired change is already dramatically underway as this new and flexible channel to customers, business partners and suppliers opens wider and wider.

Like many new opportunities, Internet changes must be pursued with a new set of tools and techniques. The old ways simply aren't effective: just as you wouldn't travel an interstate highway in a Model T, neither can you expect to exploit the competitive opportunities of the information highway with the quickly aging proprietary computing platforms still in use today.

After all, the multiple platforms that currently populate corporate information systems infrastructures are pretty much entirely incompatible with each other — nothing fits together, so exchanging information between them remains very difficult and error-prone. These platforms are also resource-intensive and incredibly complex, which makes them costly to buy and maintain and prohibitively expensive to update or expand.

But, troublesome though they may be, nobody can afford to scrap their huge investments in existing information systems. It is not practicable to toss out entire databases of

invaluable knowledge or retrain workers in new computing environments and techniques.



So what's the answer?

The answer is Java™, an entirely new kind of cross-platform computing environment that first can be placed on top of — and work with — your organization's existing systems and networks, and then later can slowly replace costlier, less efficient elements. The result? A rational, significantly less expensive information systems infrastructure where, finally, most everything does fit together and is easy to maintain, easy to grow and easy for even inexperienced desktop computer users to master.

Java uses the Internet, but Java is much more than just an Internet language. In fact, Java is a programming environment in its own right and is designed to be used in applications that venture far beyond the corporate desktop, even beyond handheld devices like personal digital assistants (PDAs) and into industrial devices, toys, cars, cellular phones, appliances — anything using a microprocessor or microcontroller.

Because it was designed from the outset as a cross-platform computing environment that exploits the openness and universality of Internet technologies, the Java computing platform makes it easy to create an Internet-based channel to customers,



WHAT IS JAVA?



So Java apps can run in any Java enabled web browser, like Netscape Navigator™ or Microsoft's Internet Explorer.

Keeping it simple. Meanwhile, JavaOS™ stands in stark contrast to lumbering, traditional operating systems. JavaOS and the Java Virtual Machine can be stored at the client in flash ROM or can be booted from the network.

Standard, open protocols. Java relies on standard network protocols like TCP/IP (which is built in) but more sophisticated client/server protocols can be used, too. The Java Database Connectivity (JDBC™) protocol provides SQL-oriented connectivity to databases. More complex, three-tiered applications can be built using distributed objects with industry-standard CORBA (Common Object Request Broker Architecture) protocols.

New kinds of clients. Java computing spans much more than traditional desktop environments. Java has been

To understand Java and its implications, begin by thinking of Java as an applications development platform. Java is a portable, interpreted, high-performance, simple object-oriented programming language and runtime environment.

Java computing puts object-oriented programming to breakthrough use: it enables network computing by downloading nuggets of Java application code (applets) from server to client on demand, regardless of the platform. Sometimes the applications are stored in cache on a client hard disk, sometimes they're stored only in DRAM.

Shifting the center of client/server gravity

Since Java applications normally reside on a server and are delivered to a client via standard network protocol only when needed, client data storage is centralized on servers, as is administration and configuration control, and desktop client computers can become "thin" again. This sort of network-centric computing enables organizations to increase the cost-efficiency of their information systems infrastructure.

Crossing platform barriers in a single bound

How does this work across all those incompatible computing platforms? The answer is the open, standards-based Java Virtual Machine. Anywhere there's a Java VM, Java applets and applications can be dynamically downloaded and run.

partners and suppliers. With Java, your organization can provide selective, secure access to key applications, so those you want — your employees, your customers, your partners — have a Java based window into the enterprise for delivery of goods, services and information.

Extending the enterprise with Java computing

Ultimately, Java is an enabling technology for a whole new kind of computing in which the network is central and most desktop clients can simply serve as interfaces to the

network. Applications and processing power are distributed among many different types of computers in many different locations, and the network controls the flow of information among authorized users. Because they are Java applications, they are written only once, then run *as is* on just about any type of computer.



An end to obsolescence

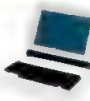
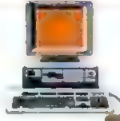
The impact of this network-centric approach on traditional computing environments is profound, because it preserves the entire system legacy,

staving off obsolescence indefinitely. Existing systems and data interoperate easily with Java enabled computers, so you can build Java frontends onto your current systems and take advantage of the benefits of Java while protecting your investments in hardware, software and training.

Consider: for your specialized applications requiring local processing power, you can keep your high-powered desktop systems and add Java computing capabilities without incurring *any* hardware replacement or retraining costs.

What's more, you can add Java capabilities now to large numbers of

THE SPAN OF JAVA: FROM PAGERS TO FAULT-TOLERANT SERVERS

EMBEDDED DEVICES	DESKTOP	ENTERPRISE
 Cell Phones Pagers PDA's Palmtops Thermostats	 PC's NC's Workstations All Major OS's	 Database Servers Networking - Infrastructure

licensed for use in "smart" telephones with built-in displays, PDA-like devices, set-top boxes, kiosks, point-of-sale devices, even home video game machines.

Unlike any other kind of computing environment, Java offers an architecture that leverages enterprise computing investments across all platforms. If you want to revitalize, not replace your legacy systems, you need Java. And if you want to exploit emerging opportunities in Internet-enabled commerce, Java is downright essential.

Customer service applications at British Telecom are being delivered with Java computing to a broader business and commercial customer base than traditional information technology permits.

your proprietary PC platforms and standalone applications, then gradually supplement them with low-cost, easy-to-administer network computers or replace them at your business convenience.

And when you're ready to take the next step toward web-based commerce, your foundation technology based on Java computing can be extended and expanded as more Java based hardware and software products continue to emerge.



Designed for the future

Java also opens up an entire new spectrum of opportunities on the Internet, the web and corporate intranets. Most organizations venture into the Internet and web-based technologies by degrees.

First comes *web marketing* — an

external website is established to inform customers and prospects about products and services. Next, in *collaborative communication*, internal websites protected from public access by firewalls form a core intranet system used to inform and educate employees.

Business applications follow, as web servers to gateway systems are installed, enabling web-based access to business-critical data. This use can even be transactional — examples include employee expense reporting, inventory control, decision support.

Finally, organizations will participate in a *networked marketplace* in which internal business applications are mature enough to be released for customer or supplier interactions through extranets or the Internet itself. At this point, corporate firewalls can be opened up for true electronic

commerce, such as online shopping and online banking.

The Java computing platform is the enabling technology supporting each of these steps, providing an easily accessible, low-risk means of establishing a web presence, a secure medium for internal and external information exchange and the foundation for true electronic commerce.

The future, long promised and long delayed, is here at last. On the pages that follow, we'll show you what Java means for enterprise computing, why Java makes business sense, and how you can start right now developing, deploying and managing Java computing in your organization.

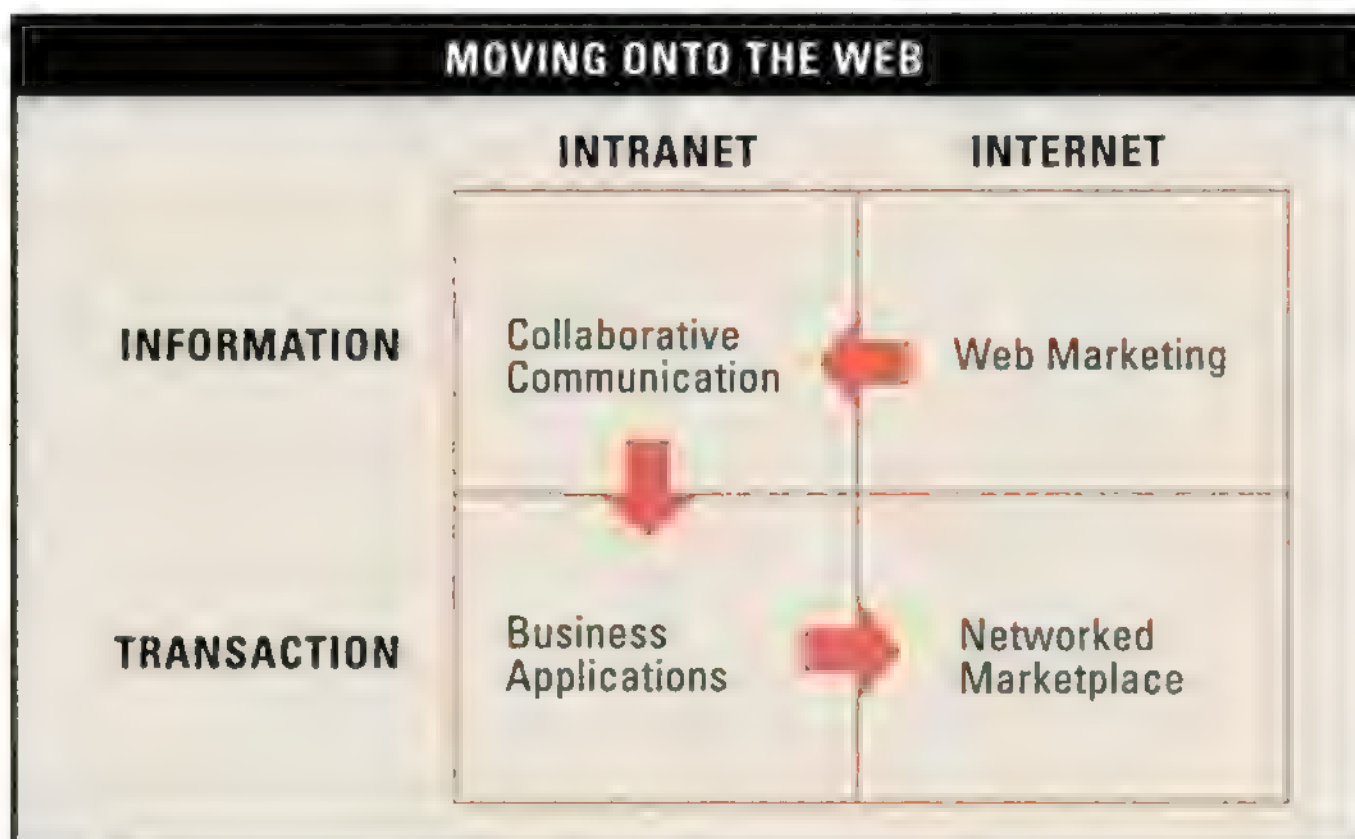
Java in context: Starting with an intranet

With a little help from Internet technologies, Java computing can combine the best of both traditional mainframe computing and the more recent client/server paradigm.

Unlike the mainframes that preceded them, distributed client/server computing enables organizations to:

- Leverage existing IT resources,
- Redistribute digital information to the desktops of a broad spectrum of users via local and wide area networks,
- Use friendly graphical user interfaces (GUIs) to improve worker productivity and potentially access data in legacy mainframe systems,
- Achieve high desktop computing performance,
- Expand systems at comparatively low cost,
- Choose from large amounts of off-the-shelf software applications,
- Develop applications more quickly.

Alas, nothing comes for free: distributed client/server computing has drawbacks, too. And a couple of the major ones are starting to hurt many organizations' ability to





WHY 100% PURE JAVA™ MATTERS: IT'S MORE THAN JUST A LOGO



By the end of 1997, industry-watchers say, there will be something like 100 million Java enabled desktops. And by the beginning of the next millennium, there will be 100 million network computers at work.

Why? Mostly because Java based network computing is platform-independent. Unlike other offerings that tie developers to a single platform, Java unites many platforms with a common language. The result: organizations can afford to exploit new Internet- and web-inspired opportunities with Java "Write Once, Run Anywhere"™ capability.

The danger of "captive" platforms

Since Java is an open architecture, anyone can use it. Today, Java is available on all major computing platforms and has been licensed for still others.

But Java platform-independence can be sustained only if everyone uses the same Java. Pure Java. In fact, we need a standard for 100% Pure Java™.

Why? Because contaminated Java loses its platform-independence and its abilities to ensure a secure computing environment. Which means that contaminated Java simply isn't Java at all. But some might still claim it's Java, even though it's a proprietary knock-off that can't do the job.

There are any number of ways this can happen. Take Microsoft's ActiveX as an example. Whereas Java makes links to components in other computing models, ActiveX encapsulates components, which thereafter can run only on proprietary ActiveX platforms. When Java is encapsulated into ActiveX, its cross-platform attributes have been compromised.

The 100% Pure Java logo: It ensures the cross-platform compatibility of Java applications

Many believe that genuine platform-independent network computing depends on establishing and enforcing open, non-proprietary standards for the Java platform. Both end users and developers need assurance that programs written in the Java language will indeed run flawlessly on any Java certified platform or device.

The 100% Pure Java Initiative, supported by more than 100 vendors, uses a variety of testing certification, technical assistance, education and co-marketing programs to guarantee compatibility in the Java environment.

Look for the 100% Pure Java logo on the products you buy to make sure that your organization's Java compatibility won't be contaminated or compromised.

What's it all about: 100% Pure Java defined

Only full compliance with the 100% Pure Java Initiative earns the 100% Pure Java logo. Here's what it takes:

- **Written 100% in Java.** The first and most obvious criterion for 100% Pure Java compliance is that the software be coded entirely in the Java language. Although Java can resemble C or C++, pure Java code cannot include C or C++ code because the resulting applet or application wouldn't take advantage of Java cross-platform capabilities. With the Java Virtual Machine, the Java platform provides a level of abstraction that hides the underlying operating system from the application; neither C nor C++ do this.

- **No native method calls.** Attempting to interface native code with Java code typically compromises several key Java benefits, most notably security. Those who mix Java and native method calls have no assurance that code will remain virus-free after download. And if a native method has a pointer overrun or tries to access unauthorized memory, the result is a general protection fault. Products that interface native code with Java code are not eligible for 100% Pure Java certification unless the desired function is also implemented in 100% Pure Java and included with the application.

- **Conforms to Java Core API specifications.** The Java API forms a standard interface to components, applets and applications and is the essential framework for application development. 100% Pure Java applications must conform with both key components of the API: the Java Core API and the Java Standard Extension API. If a 100% Pure Java Standard Extension API is used, it must be bundled with the application. The specifications for all Java APIs are freely accessible on the web at <http://java.sun.com>.

- **Bundles libraries or uses libraries included in the Java Reference Implementation.** Libraries invoked by Java applications must also be 100% Pure Java or JDK™ libraries to guarantee that the applet or application invoking them remains 100% Pure Java compliant. The Java Reference Implementation is available on the web at <http://java.sun.com>.
- **Passes certification test.** A simple yet thorough test suite has been developed by Sun Microsystems, Inc. that will help ensure that certified products have all of the cross-platform attributes of a pure Java application. Each individual product that passes the 100% Pure Java test suite will be certified and become eligible to use the 100% Pure Java logo on packaging, advertising, websites and marketing materials. As part of the certification agreement, the software may be audit tested with updated versions of the test suite at any time.



100% Pure Java benefits everybody

Products that have achieved 100% Pure Java certification are written entirely in Java according to these requirements,

Continued on page 56



Continued from page S5

have been successfully tested for compliance using the 100% Pure Java test suite and have been submitted to an independent testing center for formal certification testing.

So when you see the 100% Pure Java logo, you know you'll get:

- **Compatibility with all platforms, not just "Wintel," and not just the Mac.** Users of 100% Pure Java products are secure in the knowledge that their applications are truly multi-platform.

- **Higher-quality Java applets, applications and JavaBeans™ component APIs.** The 100% Pure Java Initiative eases the transition to Java based computing, an end-to-end, secure network computing solution based on distributed Java applications and low-cost Java network devices.

exploit competitive opportunities:

- Distributed client/server systems carry high and still-growing desktop management costs, due chiefly to their dependence on expensive networked PCs — so-called "fat clients" — that too often run only "thin" applications, and,

- A rigid application architecture limits the ways in which computers can add value when executing transactions, servicing customers, analyzing data and so on.

Java based shipping and tracking applications deployed into major customers' workplaces via network has already saved CSX \$6 million in application development, distribution and upgrades.



The advent of network computing

What's the solution? A low-cost, low-administration network-access desktop that couples the flexibility of client/server systems with the centralized maintenance and administration of mainframes. This is network computing and what it offers is worth noting:

- ☑ Centralized IT management,
- ☑ Low-cost, easy-to-replace desktops,
- ☑ Ability to instantly update applications on all network computers, thus eliminating versioning problems,
- ☑ Elimination of local administration of configuration files,
- ☑ Low desktop management cost,
- ☑ Scalability, allowing a comparatively high ratio of network computers per server.



Time for a thin client

At the heart of this merger of computing paradigms is the notion of a "thin client," a stateless desktop device linked via network to one or more servers. Everything that constitutes a state — the operating system, applications, data, integrity, etc. — has been relocated from client to server. While this stateless, thin-client network computer is skinny in terms of desktop management costs, it's actually remarkably rich in function-

- **Greater satisfaction.** With 100% Pure Java certification, it's easier to quickly recognize products that won't jeopardize your organization's cross-platform computing capabilities or the security of its transactions.

- **Faster evolution of the Java platform.** Clearly, the Java platform makes application development work easier. Java is a small, "knowable" system coupled with an increasingly comprehensive set of component APIs, so developers can build applications from shared, reusable objects.

The 100% Pure Java Initiative, supported by more than 100 independent computing vendors, defines an objective, consistent quality standard for Java software and publishing API specifications. Keep your future safe. Use only 100% Pure Java.

ality. That's because of the Internet and the nature of the Java language.

Standard, open Internet technologies and protocols form a universal networking capability which can be easily inserted — if it hasn't been already — into an organization's information systems infrastructure. This ability to access every computer means the recentralization of certain capabilities — such as desktop systems management — again makes economic sense.

Meanwhile, just what can be effectively recentralized depends on software techniques that emphasize modularity, reusability, reliability and ability to function in a network environment. This is called component-based software and Java is its premiere embodiment; the idea is to construct applications by assembling reusable parts into new applications. Component-based software like Java consists of three elements:

- **Components:** software objects, either simple or complex, that include some program logic.

- **Containers:** objects used to assemble components and provide a context in which they interact.

- **Scripting:** the ability to initiate and direct interactions between components.

In Java based network computing, the favorite container is a web browser

like Netscape Navigator or HotJava™, which includes Java container software, The Java Virtual Machine. Components can be loaded not just from a file server but also from a web server located on a corporate intranet or somewhere on the Internet. And these components can contain much more than merely text or graphics files — Java components can carry executable code, so data can be downloaded along with the code required to work with that data.

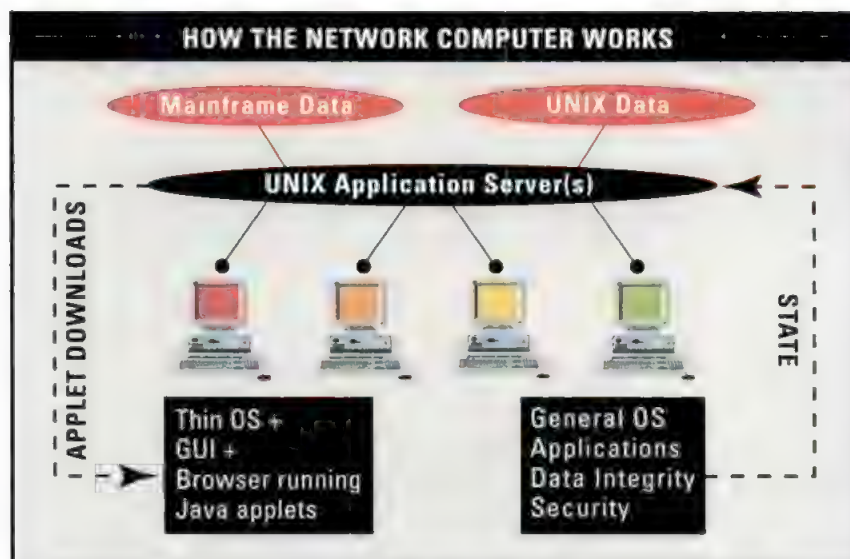


From applet to enterprise

These days, Java is used for much more than creating applets, those small applications typically embedded in web pages and run from within a web browser. Increasingly, Java is going mission-critical and being used to create full, standalone applications. For instance, Corel is developing a version of its Office Suite, including WordPerfect, written completely in Java that will be able to run on all computer platforms that support Java.

Indeed, interest in Java is growing fast and some estimate that there are already 300,000 people programming in Java. It's not hard to see why. The Java platform gives developers a powerful object-oriented language without the complex, heavyweight object housekeeping required by other models. Its compact runtime framework is easy to include in a range of devices, from smartcards to kiosks. Designed from the outset to be network-aware, Java support for the Internet's TCP/IP protocol is built in.

Java applications easily adapt to changing environments, since users dynamically download code from anywhere on the network. Processing is neither centralized nor entirely localized — it's flexibly distributed depending on the requirements of the



job. Java applications are fast, because today's processors provide efficient virtual-machine execution. Just-in-time compiling and Java microprocessors can deliver even more performance, while Java built-in multithreading means high-performing graphical applications and GUI functions.

With Java runtime system managing memory and inspecting all code before it's downloaded, Java apps are robust and secure. Component-based Java is simple to learn and use and speeds application development and turnaround, thanks to code reuse, easier testing and rapid internet deployment.

The advantages of Java computing

It's worth taking a closer look at how organizations can expect to benefit from Java based network computing.



Platform-independent open computing

Deployment of consistent Java Virtual Machine platforms enables you to run any Java compliant application program across the enterprise. Because Java runs on the Windows, Macintosh and UNIX® platforms, it's possible to "Write Once, Run Anywhere," giving Java applica-

tions the world's largest user base.

This eliminates the need to port applications to separate, incompatible client environments and it overcomes the lack of availability of certain application features and functions on inherently limited platforms. Also, organizations are no longer trapped into having to deploy incompatible platform-dependent applications.



Less complex computing environment

Since all code, data and configuration information are stored and managed centrally, computing life is easier for everybody: applications, data and infrastructure resources can be managed from one place. This results in:

☑ *Dramatically lower costs of administration and ownership.* One Fortune 500 company with 15,000 computing seats expects to save as much as \$100 million in hardware and software maintenance costs by switching from PCs to Java thin-client seats.

☑ *Rapid development and deployment of new applications.* "Write Once, Run Anywhere" Java reduces time spent on application development, testing and rollout, so there are more resources left for creating new added-value applications. Java developer productivity is two to five times greater than with traditional

languages like C and C++, thanks to such Java capabilities as strong type checking, automatic memory management and exception handling. This sort of instant rollout of applications on an intranet website permits shorter, more iterative application development cycles, an ability to react quickly to bugs and happier users.



Improved security on an enterprise scale

Java addresses several vulnerabilities of current enterprise computing environments:

- **Strong memory protection.** Java applications and applets cannot gain

unauthorized memory access to read or change accounts because Java removes the possibility of either maliciously or inadvertently reading and/or corrupting memory locations outside boundaries of the program.

- **Encryption and signatures.** Java uses powerful encryption technology to verify that an applet came from an authorized source and has not been modified.

- **Rules enforcement.** Java objects and classes make it simple to represent corporate information entities, and the rules governing their use is embedded within the objects themselves — the result is that the introduction of ad hoc access

and manipulation methods can be controlled.

- **Runtime verification.** Java runtime verification system inspects all code for viruses and tampering before running it, ensuring that all applications and applets downloaded to the client will not violate the integrity of the environment.

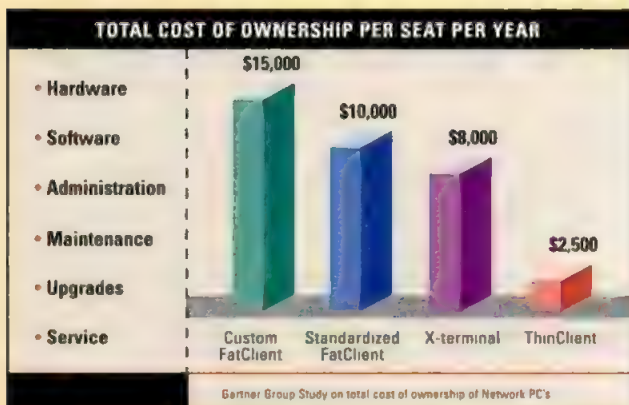


Greater reliability

The Java language itself, meanwhile, encourages production of reliable, simple code. Its object and component orientation promotes re-use and library-building. Java also

FAT CLIENTS VS THIN: COST AND BENEFITS

In traditional enterprise computing, a client machine is typically a PC that runs a highly complex operating system and uses much of its substantial supply of memory and local storage to house an assortment of resource-intensive applications, including e-mail and other network access software.



These are "fat clients" and they're rather pricey. The total cost of owning a networked Microsoft Windows-based PC — including the original purchase price, software updates and upgrades, configuration assistance, technical troubleshooting, and other needs — adds up to nearly \$12,000 per year, according to the Gartner Group.

By comparison, the same Gartner Group research indicates that the kind of "thin client" that Java computing makes possible costs just \$2,500 per year. Part of that is the original pricetag: thin Java clients need less local storage, since all code, data and configuration information are stored and managed centrally.

But there's more to it than machine price. Up to 55% of a PC's total cost over a five-year period, reports Gartner, comes from software product updating. This task is hugely simplified by the centralized administration and management that's a hallmark of thin-client network computing.

So just how much can an organization save by shifting from fat clients to thin ones and adopting Java based computing?

Compare the cost of a 1,000-node environment, figuring the cost of thin Java clients at \$2,500 per year and fat clients at between \$10,000 per year (standard) and \$15,000 per year (custom).

100% fat-client PCs	\$10.00 million
90% Java network computers 10% fat-client PCs	\$ 3.75 million
Potential saving with Java	\$ 6.25 million

How quickly you decide to shift from your fat clients to Java network computing will go a long way toward determining how much of what you're now spending on traditional PC environments can be saved.

promotes good software engineering practices, such as clearly separating interfaces from implementation and easily handling exceptions. And Java automatic memory management and lack of programmable memory management tools such as pointers eliminate one of the largest causes of programming errors.



Revitalization, not replacement

Java will save your legacy systems from obsolescence by layering on top of them a universal means of access and update. Since Java enabled browsers can display any HTML page, they can run forms-based HTML applications. With web servers acting as gateways to legacy systems, HTML can be used as a way to publish information within and beyond your organization so the right people – employees, suppliers, even customers – can get the information they need when they need it.



Incremental implementation

With Java, you can make the shift to thin-client, network computing gradually, as your budget and your business require. Given that Java works perfectly well on fat clients, too, once you've installed Java enabled browsers at all of your organization's desktops, migration to a network computing environment can be conducted in small, controlled steps without immediately discarding even a single computing platform or application.



Easier adoption of online technologies

Whether your organization is just beginning to move onto the Internet and establish a presence on the World Wide Web or you're marching toward full-fledged web commerce, Java

Balance sheet applications at First Union National Bank run under 3270 emulation on thin-client JavaStation™ network computers, to be followed by Java applications that access databases on mainframes and servers. Result: Total cost of computing has dropped from \$4,000-\$5,000 per seat per year to well under \$1,000.

makes it all easier, more secure, less expensive and more scalable and flexible for future growth.

What, then, can Java mean for *your* organization? Quite simply, the end of information system incompatibilities and isolation. And an unparalleled ability to adapt computing systems to changing conditions, because, finally, applications can be sent to users wherever they are, no matter what desktop computer or network computer they're using.

You've been hearing these promises for years, of course. So consider, just one more time, what it means to have such promises fulfilled. It means a breakthrough, stunning in its scope, an innovative yet safe choice that fully delivers on the promise of enterprise compatibility and connectivity – with zero client administration cost. And there are many Java choices indeed.

The need for 100% Pure Java

Java platform-independence works as long as vendors continue using the same Java and resist the urge to add non-uniform features that destroy its portability.

This is always a risk. In Microsoft's ActiveX component software strategy, for instance, Java applets are swallowed whole (encapsulation) and are no longer able run on anything but

Microsoft's proprietary Win32 platform.

In fact, the risk of contaminated Java is strong enough that more than 100 vendors, led by Sun Microsystems, Inc. have launched the 100% Pure Java Initiative that defines an objective, consistent quality standard for Java software and publishing API specifications.

Only products that have achieved 100% Pure Java certification can exhibit the 100% Pure Java logo. The logo's presence on software and hardware products indicates its compatibility with all other 100% Pure Java products. So Java buyers get better products and more effective network computing environments.

Java's many facets

A program written in Java can run wherever a Java platform is present, regardless of the underlying proprietary platform, without needing to be compiled for any particular underlying platform.

Each underlying platform has its own implementation of the Java Virtual Machine, but since there's only one Java Virtual Machine specification, the Java platform acts as a standard, uniform programming interface to applets and applications on any hardware.

An end-to-end solution encompassing hardware, software, develop-

Key business applications at FedEx are being browser-enabled with JavaStations that replace tens of thousands of terminals.



JavaOS

The first system software specifically designed to execute Java programs on web-based network computers, the Java operating system that implements the Java Base Platform is being widely ported to micro-processors, including the JavaChip™ family.

JavaOS is written in Java and includes the Java Virtual Machine and class libraries, plus the system software necessary to run them

without a full-blown operating system. Unlike other operating systems, JavaOS requires no filesystem, no virtual memory subsystem, no multiple address spaces and no support for multiple programming languages.



The Java Base Platform

The minimum that must be present for running Java powered applets and applications on network computers, desktop computers and workstations is described as the Java Base Platform. It contains the Java Virtual Machine

ment tools, management and administration tools, security and services, Java takes many forms.



As more and more businesses come to understand the important role the Internet already plays in their competitive futures, a critical question arises: Java or Microsoft's ActiveX?

Both are object-oriented component software strategies — they build applications from reusable parts by plugging software components into some kind of container — but the capabilities they can each bring to an organization differ dramatically.

Multi-lingual vs. multi-platform

Like Java applets, ActiveX controls are self-contained pieces of functionality that run inside some kind of container. But unlike Java applets, ActiveX controls can be written in various languages (C++ is most common).

The tradeoff comes at the other end: Java applets are downloaded in a machine-independent format and

either just-in-time compiled (faster) or interpreted in any container with the Java Virtual Machine software installed (slower); but ActiveX controls are binaries and typically require Intel-based hardware that supports the Win32 interface — i.e., Windows 95 or Windows/NT.

Of security and sandboxes

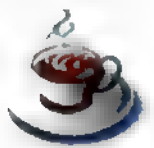
For computing security, users trust their servers not to deliver malicious components. What else can be done? A couple of things: sandboxing, which constrains downloaded components from executing functions that can damage the local system; and digitally signing each downloaded component, so signatures can be checked by the local system.

Beside trusting servers, Java supports sandboxing and Java developers are at work on digital signing of downloadable components. ActiveX offers digital signing, too, but since ActiveX controls have full access to a computer's operating system, files and applications, sandboxing is not an option, and users still could end up with ActiveX controls that behave like viruses or act maliciously.

COMPARING JAVA AND ACTIVEX

JAVA		ACTIVEX	
PRO	CON	PRO	CON
- Works across many types of platform - Components are reusable - Programs written once can be run on many diverse machines - Users safe from rogue code - Fast-growing support from software vendors	- Young technology - Small installed base - Not well understood - Requires knowledge of the programming language—however, Java visual tools are coming to market that enable developers to work in Java without knowledge of the Java programming language	- Runs in all Windows applications - Extends existing technology for using software objects - Has support from software vendors	- Runs only in Windows - Large components (ActiveX controls) - Much code is not reusable - Users could download viruses, rogue code

and a minimal API set — known as the Java Base API or the Java Applet API — to run basic applets and applications. Developers writing to this minimum set can feel secure that their Java programs will run anywhere without need for additional class libraries.



The Java Virtual Machine

A “soft” machine that can be implemented in either hardware or software, the Java Virtual Machine is an abstract computer designed to reside atop existing processors. Its porting interface and adapters enable it to be easily ported to new operating systems without being completely rewritten.



Java APIs

The Java platform has been extended beyond the Java Core API with the Java Standard Extension API, which is a published, uniform, open standard available to anyone wishing to implement an extension. As Java APIs continue to proliferate, some of the Standard Extension API will migrate to the Core API. Together, these form a standard interface to applets and applications, and they're the essential framework for Java application development.

JavaBeans™ enhance the Java platform still further by facilitating richer, more dynamic interactions between components. JavaBeans can be implemented in web browsers or as standalone applications by layering them on top of existing environments. The actual implementation is hidden by the JavaBeans APIs, so developers can write application components without regard to the platform on which the component will eventually run, since the code is portable among all Java enabled platforms.

The JavaBeans specification defines

a set of standard, device- and operating system-independent component software APIs for the Java Platform. Designed by a partnership of industry leaders, JavaBeans is the ideal choice for developing or assembling network-aware solutions for heterogeneous hardware and operating system environments — within the enterprise or across the Internet.

A JavaBeans component can be anything from a GUI widget to a robust component to a full-scale application. Because it'll run on any platform with a Java Virtual Machine, a JavaBeans component can be re-used everywhere, incorporated into multiple solutions without the need to rewrite a single line of code.

JavaBeans component software integrates seamlessly with other industry component models, such as ActiveX, with no additional development required. And this interoperability is free, via a Sun Microsystems-developed ActiveX control called the JavaBeans Bridge for ActiveX, which lets JavaBeans run in legacy ActiveX containers like Microsoft Office and Visual Basic.

A wide range of JavaBeans resources and rapid application development tools are already available. You can leverage a growing array of outstanding tools for the enterprise, the web and commercial development, including IBM's AppletAuthor and VisualAge for Java, Powersoft's Jato, Java™ Workshop™ and Project Studio from Sun Microsystems, Inc. JBuilder from Borland, Visual Cafe from Symantec, and Mojo from Penumbra Software.



The Java language

As professional programming languages go, Java is simple, flexible and powerful. Source code written in Java can call an assortment of APIs. Java enables developers to do several kinds of things critical to enterprise computing and encourages catching bugs early, during design and development. Its multithreading capabilities will enable a new generation of concurrent applications and services.



HotJava Browser

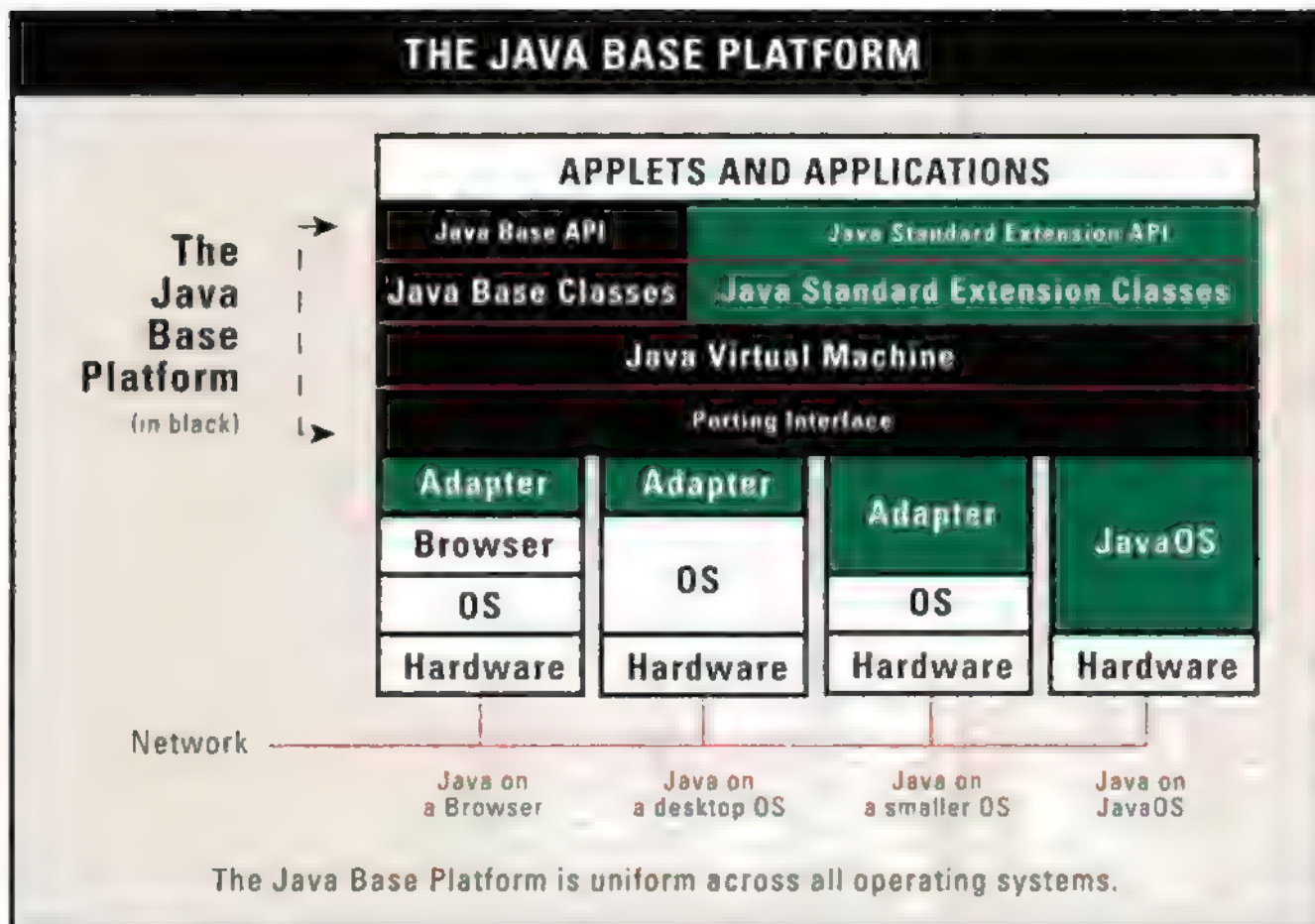
The first major application created using the Java language and its run-time system, the HotJava Browser is a highly-customizable, extensible web browser. Users can easily modify the user interface to provide their own look and feel.

HotJava Browser accesses applications in a new way: software migrates

COMPANIES LICENSING THE JAVA BASE PLATFORM TO EMBED IN OPERATING SYSTEMS

Windows	Microsoft Corp. IBM Corp.	Windows 95, NT Windows 3.1
Macintosh	Apple Computer	Mac OS
OS/2	IBM Corp.	OS/2
UNIX	Hewlett-Packard Hitachi Ltd. IBM Corp. Silicon Graphics SunSoft, Sun Microsystems The Santa Cruz Operation Tandem Computers	HPUX Hitachi OS AIX Irix Solaris™ UnixWare Non-Stop Kernel
Network OS	Novell	NetWare 4.0
Mainframe OS	IBM Corp.	MVS

transparently across the network as it's needed. No longer does software have to be “installed.” Although HotJava Browser is very small, since all of the protocol and data handlers are brought



in from the outside, its ability to seamlessly deliver dynamic content, dynamic data types and dynamic protocols means content creators now have an entirely new tool to use in the fast-emerging worlds of electronic commerce and education.



Java Development Kit

You can develop both applets to run in browsers supporting JDK 1.1 (such as HotJava and Netscape Navigator and Microsoft Internet Explorer) as well as standalone Java applications with JDK 1.1, which now features JavaBeans, database connectivity and enhancements to security, networking and performance.

JDK 1.1 includes a runtime version with interpreter and core classes, tools (including source files, compiler, debugger and much more) documentation and demos.



JavaStation

Sun Microsystems' new line of Java enabled network computers,

JavaStation systems, are optimized for Java computing and can serve as both interfaces and nodes in a Java enabled network. JavaStations have significant local processing power and take advantage of the network for all storage requirements, minimizing cost and maximizing network resources.



JavaChip family

Java processors offer significant advantages over general-purpose microprocessors in terms of performance, power and cost optimization:

- *picoJava™* is designed to be the industry's best price/performance silicon fabrication supporting the Java Virtual Machine specification and will be used in cell phones, printers and other business and consumer products.

- *microJava™* adds I/O, memory, communications and control functions to the picoJava core. Controllers, service station kiosks, telecom carrier equipment and the like will use microJava chips.

- *UltraJava™* leverages advanced

graphics circuits and features next-generation enhancements, making it an excellent solution for advanced 3-D graphics and other multimedia-intensive applications.



Of partnership and value added

In addition to Java development efforts by Sun Microsystems, Inc. and JavaSoft, many other vendors have grasped the breakthrough significance of Java and are hard at work on Java enabled products that exploit the competitive advantages of web-based network computing and electronic commerce. The list of Java committed vendors is long, distinguished and getting longer.

Java computing with 100% Pure Java opens up a whole new spectrum of opportunities and possibilities for your company. It's a true breakthrough in technology that enables your business to create breakaway success strategies.

Network computing is here, solving some of the most challenging problems that enterprises face. A complete, end-to-end network computing solution, Java computing is more than a single breakthrough, it's a series of innovations that carry the future of enterprise computing.

Now is the time to carefully consider the possibilities and opportunities that Java computing opens up for your organization.



For more information about Sun Microsystems, Inc. JavaSoft or the 100% Pure Java Initiative, please visit our website at <http://java.sun.com> or <http://www.javasoft.com> or call 1-800-PURE JAVA.

modules, and CGI scripts could previously perform, including maintenance of state information related to individual requests, clients, applications, and servers; manipulating binary and text files; and Web-based database management.

FEATURES

Hot on the heels of the release of Communicator and Navigator 4.0, Netscape published the specifications for JavaScript 1.2. With this latest version of JavaScript, Web developers gain tighter integration with the windowing

environment, more control over script execution, and finally, total control over the placement and layering of text, images, and all other objects in a Web page.

The layering of text, images, and other objects in JavaScript 1.2 is handled with a Z-order layering model. Although this may sound like *Star Wars* technology, the Z-order of elements on a page simply refers to their placement above and below other elements along the z-axis (the axis perpendicular to the page surface).

If you've ever clicked on a menu in a Win-

dowing application, you've witnessed firsthand what happens when an element with a higher Z order is displayed on the screen—the menu displays on top of everything else. Thus, you can layer elements in front of or behind other elements.

In addition to layering, Netscape added JavaScript-based stylesheets. They help Web developers gain control over the placement and style of elements in a Web page. Your stylesheet can specify the spacing around elements as well as their positioning on-screen. You control the style of elements by specifying the precise colors, fonts, and backgrounds for the elements you want to customize.

After the initial euphoria over the layering model and JavaScript-based stylesheets wore off, I put JavaScript 1.2 through the paces. It was then I realized, somewhat ironically, that just as VBScript 2.0 took a step forward into more object-based functionality, JavaScript 1.2 in some respects took a step backward to more traditional programming.

Some of the more traditional programming functions you will now find in JavaScript include break and continue statements, do ... while constructs, and switch ... case constructs. Netscape even introduced a disguised implementation of the dreaded GOTO, which may prove to be a Web developer's greatest nightmare when it comes time to debug.

SCRIPTING WITH JAVASCRIPT

JavaScript is the perfect tool for customizing Web pages to meet the needs of individual users. Using features built into JavaScript, you can determine what type of browser the user has and automatically customize the Web page for that browser. Yet customizing Web pages for individual browsers is only the beginning. You can also use JavaScript to customize Web pages based on user preferences, operating system, country of origin, language, and more.

JavaScript also handles real-time interaction on Web pages. As is also the case with VBScript, real-time interaction with JavaScript is mainly based on intrinsic controls. With JavaScript, push buttons can call functions, check boxes can display dialog boxes, and text input fields can react to changes.

JavaScript can also be used to validate user entries on forms before they are posted to a server. Client-side form validation saves time and resources by eliminating the back-and-forth processing between the user's browser and your Web server.

Forms that validate themselves are pretty cool, but you are probably wondering what other advanced features can be implemented with JavaScript. How about pages that update themselves?

```
<HTML>
<HEAD>
<TITLE>The Browser Reporter</TITLE>
<SCRIPT LANGUAGE="JavaScript">
<!--

function report() {

var repWindow = window.open("", "ReportWin", "HEIGHT=250, WIDTH=300")

if (repWindow != null) {

var repPage = ""
repPage += "<HTML><HEAD><TITLE> Browser Report Utility </TITLE></HEAD>"
repPage += "<BODY BGCOLOR='#FFFFFF'"
repPage += "<H2 ALIGN=CENTER>Browser Summary</H2>"
repPage += "<P><B>Name:</B> " + navigator.appName
repPage += "<P><B>Code Name:</B> " + navigator.appCodeName
repPage += "<P><B>Version:</B> " + navigator.appVersion
repPage += "<P><B>System Info:</B> " + navigator.userAgent
repPage += "</BODY>"

repWindow.document.write(repPage)
repWindow.document.close()

}

}

// -->

</SCRIPT>

</HEAD>

<BODY BGCOLOR="#FFFFFF">

<H1>Browser Report</H1>

<FORM>
<INPUT TYPE=BUTTON NAME=aButton
VALUE="Display Report" OnClick="report()">
</FORM>

<HR SIZE=5 NOSHADE>

</BODY>
</HTML>
```

FIGURE 9: A browser reporting utility.



Web pages that use JavaScript to update themselves are the future of the Web. Self-updating pages can rotate content weekly, daily, hourly, or even randomly.

To show how you can use JavaScript in a Web page, I will create a basic utility that will get you started on the road to customizing your Web site for individual browsers. The key to customizing pages for individual browsers is the navigator object.

The navigator object has four properties that can help you obtain information about a user's browser. These properties are appName, appCodeName, appVersion, and userAgent.

The appName property returns the official name of the user's browser, such as Netscape. The appCodeName returns the internal code name of the browser, such as Mozilla. AppVersion returns version information pertaining to the browser and includes the version number, platform, and country code, such as 4.0 (Win95; I). The userAgent property returns a combination of the appCodeName and appVersion data, such as Mozilla/4.0 (Macintosh; I; 68K).

The source code for the browser reporting utility is shown as Figure 5. This script sends the values of the navigator object's properties to a browser window.

As you examine the listing, note the syntax

and structure of scripts written in JavaScript. Note also that when the Web page's push button is clicked, the report function is executed.

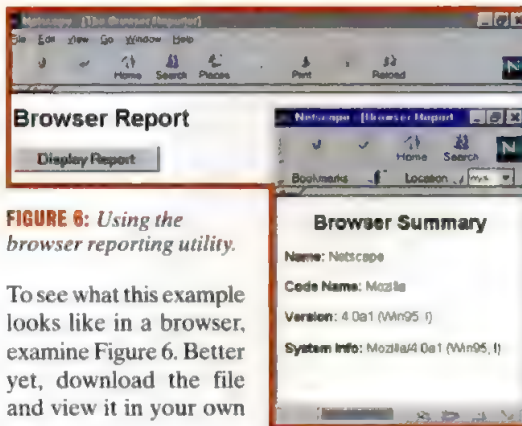


FIGURE 6: Using the browser reporting utility.

To see what this example looks like in a browser, examine Figure 6. Better yet, download the file and view it in your own browser.

VBSCRIPT 2.0 VS. JAVASCRIPT 1.2

Both VBScript and JavaScript have their strengths and weaknesses. Through a head-to-head comparison, you'll discover that there are times when you may want to use one over the other. Keep in mind that this comparison examines only the client-side core functionality of JavaScript and VBScript.

As I studied the two scripting languages, I found eight common areas where I could per-

form a head-to-head comparison. Please see the table below.

• **Array handling.** In Web scripting, you will often need to perform operations on arrays. One of the basic functions you may need is a sort function, and only JavaScript supports it. When you work with advanced data structures, you may find that you need multidimensional arrays. Here, VBScript comes to the rescue with its support for arrays with up to 60 dimensions.

• **Control flow.** VBScript and JavaScript are very similar in the ways you can control the flow of your script. The only exception is that JavaScript supports GOTO-like structures and VBScript does not.

But before you use JavaScript's labels for jumping around your code, consider all the headaches you may experience when you try to debug your scripts.

• **Operators.** Because JavaScript has roots in Java, which borrows operators from C/C++, JavaScript has many more operators than VBScript. JavaScript's change by value operators offer shortcuts for arithmetic and logical operations. JavaScript's bitwise operators allow you to perform binary math, which you may

VBSCRIPT AND JAVASCRIPT: HEAD TO HEAD

	VBScript 2.0	JavaScript 1.2
Array Handling		
Single dimension	✓	✓
Multiple dimensions	✓	✗
Sort function	✗	✓
Convert array to string	✓	✓
Control Flow		
For looping	✓	✓
For each/in looping	✓	✓
If ... then ... else	✓	✓
Select and switch case	✓	✓
While looping	✓	✓
Do while looping	✓	✓
Break/exit function	✓	✓
GOTO (labels)	✗	✓
Operators		
Arithmetic (+, -, /, *)	✓	✓
Comparison (<, >, <=, >=, <>)	✓	✓
Logical and Boolean (AND, OR, XOR)	✓	✓
Modulus arithmetic	✓	✓
Unary negation	✓	✓
Exponentiation	✓	✓
Object equality and inequality	✓	✓
Bitwise operations	✗	✓
Change by value	✗	✓
String concatenation	✓	✓

	VBScript 2.0	JavaScript 1.2
Math Operations		
Absolute value	✓	✓
Cosine, sine, and tangent	✓	✓
Arctangent	✓	✓
Arcsine and arccosine	✗	✓
Log and natural log (e)	✓	✓
Square root	✓	✓
Round numbers	✓	✓
Generate random numbers	✓	✓
Compare minimum or maximum	✗	✓
Math floor or ceiling	✗	✓
Object comparisons	✓	✓
String Handling		
Extract substrings	✓	✓
Extract strings based on position	✓	✗
Convert to uppercase	✓	✓
Convert to lowercase	✓	✓
Examine string length	✓	✓
Associate HTML markup	✗	✓
Obtain index of substrings	✓	✓
Split string	✓	✓
Reverse string	✓	✗
Perform filter comparisons	✓	✗
Search and replace within a string	✓	✗
Trim leading and trailing spaces	✓	✗
Obtain ASCII code for character	✓	✗
String format controls	✓	✗
Format as currency	✓	✗

	VBScript 2.0	JavaScript 1.2
Date Handling		
Work with dates	✓	✓
Work with time serials	✓	✓
Extract date information such as day or hour	✓	✓
Extract time zone offset	✗	✓
Convert to GMT	✗	✓
Examine week of year	✓	✗
Date addition functions	✓	✗
Date difference functions	✓	✗
Data Conversion		
Strings to dates/Dates to strings	✓	✓
Strings to integers/Integers to strings	✓	✓
Strings to floating points/Floating points to strings	✓	✓
Support for Hex, Oct, and Binary	✓	✓
String to Boolean/Boolean to string	✓	✗
Convert character to ASCII code	✓	✗
URL-encode strings	✗	✓
Convert to currency	✓	✗
Convert object to string	✗	✓
Input/Output		
Message dialogs	✓	✓
Input dialogs	✓	✓
Control over dialog buttons	✓	✗
Control over dialog positioning	✓	✓
Associate files with dialog window	✓	✓
Set and get cookies	✗	✓
Read and write text files	✓	✗

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CIRCLE 060 ON READER SERVICE CARD

need for files in binary format.

- **Math operations.** As you can see from the table, only JavaScript supports the arcsine and arccosine trigonometric functions; VBScript users will have to derive these from arctangent. JavaScript also features additional support for determining minimum and maximum values as well as math floor and ceiling.

- **String handling.** The ability to perform filter comparisons as well as search and replace within strings puts VBScript well ahead of JavaScript. You can use filter comparisons to extract information from strings based on

characters in strings to a form that can be passed safely to a Web server. JavaScript also allows you to convert object references to string representations. Although VBScript does not allow either of these, it does allow you to convert characters to their ASCII code equivalent and also lets you convert strings to currency.

- **Input/output.** VBScript has a very advanced structure for controlling the types of buttons on dialog boxes. For example, you can add buttons like OK, Cancel, Retry, and Ignore to dialog boxes. But best of all, VBScript features the underlying framework that lets your

tate and update advertisements;

- generating smart frames on the fly that can be manipulated directly with JavaScript;
- controlling and using object layering;
- storing and retrieving client state information in cookies;
- connectivity with Java applets and Netscape plug-ins through Netscape's LiveConnect technology.

Despite the strength and versatility of JavaScript, VBScript also has a place in Web scripting and can be used to perform tasks not easily accomplished in JavaScript. Moreover, many of the objects that are available in JavaScript are supported in VBScript as intrinsic controls. The areas where VBScript excels are in:

- advanced manipulation of strings and dates;
- working with currency;
- working with complex data structures stored in arrays;
- reading and writing text files with client-side structure;
- connectivity with ActiveX and the ability to manipulate ActiveX controls.

SUMMARY

The strengths that some users see in VBScript and JavaScript might also be viewed as weaknesses by other users because of the primary technologies to which they are linked. Just as VBScript is tied to Microsoft technologies, JavaScript is tied to Netscape. VBScript works best in Microsoft Internet Explorer. JavaScript works best in Netscape Navigator.

If you need server-side solutions for either VBScript or JavaScript, you are further tied to either Netscape or Microsoft technologies. The server-side implementation of VBScript depends on Microsoft's Active Server technology. The server-side implementation of JavaScript depends on Netscape's LiveWire object framework, which runs only on Netscape Web servers.

In the next issue of *PC Magazine*, we will take a look at Microsoft's JScript and Netscape's JavaScript. In addition to a head-to-head comparison of these two very different specifications for JavaScript, I will show you how to create scripts that will run in both Microsoft Internet Explorer and Netscape Navigator. □

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Browsing the Web with JavaScript

Because JavaScript is an interpreted scripting language, you do not need to compile the scripts. Instead, your scripts are directly interpreted line by line when they are executed in the user's browser. The browser component interpreting the script is the JavaScript interpreter.

The first browser to support JavaScript was Netscape Navigator 2.0. Since then, JavaScript has undergone two revisions. As a result, if you want to use the latest and greatest features of JavaScript, Version 1.2, you need the latest and greatest version of the Netscape Navigator—Version 4.0.

Currently, Netscape Navigator 4.0 is

bundled with Netscape Communicator, a suite of applications that includes clients for Web browsing, Web page creation, e-mail, and much more. You can obtain a preview version by visiting home.netscape.com/comprod/mirror/client_download.html.

Although Netscape Navigator is certainly the key JavaScript supporter, it isn't the only browser to do so. Microsoft's Internet Explorer supports JavaScript as well. Microsoft's implementation of JavaScript is called JScript. Although the two are similar, JScript includes features that JavaScript doesn't and vice versa. We'll be taking a closer look at this in the next issue.



searching and matching, as you can do with Unix sed, awk and grep. VBScript also support currency formatting and manipulation. The associate HTML markup category refers to JavaScript's ability to associate HTML highlights, such as bold and blink, with text strings. When the strings are displayed, the appropriate HTML markup is added to display the highlighting.

- **Date handling** refers to the types of operations you can perform on dates, times, and date strings. Although JavaScript allows you to examine time zone offsets and convert dates to GMT, VBScript supports a much more advanced date-handling structure. Using it, you can add dates and determine the difference between dates easily.

- **Data conversion.** Both JavaScript and VBScript have strong and weak areas in data conversion. With JavaScript, you can easily URL-encode and URL-decode strings. You can use URL encoding to convert special

scripts react based on the type of button selected. It also supports fairly advanced functions for reading and writing text files. On the other hand, JavaScript allows you to maintain client state information with cookies—a feature that is not available in VBScript.

OBJECTS

A comparison of VBScript and JavaScript would not be complete without considering objects. Many Web developers find JavaScript's solid base in object-oriented programming refreshing. Using JavaScript's objects you can perform many complex tasks that would be very difficult to implement in VBScript.

The diversity of JavaScript's object base makes it a solid choice for many advanced functions, including:

- customizing pages for individual users and client browsers;
- creating pages that can update themselves;
- creating graphical banner engines that ro-

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Partitioning Your Hard Disks

What you need to know before you start.

By Neil Randall

If you were to compile a list of your favorite rainy day activities, it's a good bet that partitioning your hard disk wouldn't be among them. If you're like most people—novices and veterans alike—the very idea of partitioning is terrifying. Once you delete a partition, there is no turning back, so you must be absolutely certain of what you're doing before you begin.

If you delete a partition, you not only delete *all* data in it, but you also render that part of your hard disk inaccessible to your operating system. So if your hard disk consists of only one partition, as the disks in most new computers do, then deleting the partition would mean that you couldn't access your drive *at all*, not even if you were to boot from your emergency floppy disk (you've made one, right?).

If you've made up your mind to modify your partitions, be sure to make a complete backup before you use any disk-partitioning utility. DOS and Windows 95 include a small program called FDISK, which until a few years ago was the only readily available utility for creating and deleting partitions. To access the utility, type "fdisk" at the DOS prompt and press Enter. A small menu, from which you can get all your partition information, will pop up. Move around the menu to your heart's content, but for safety's sake you should avoid item 3, "Delete partition of Logical DOS Drive." FDISK runs you through several confirmations before deleting a partition, but why take the chance? On the other hand, item 1—"Create DOS partition or Logical DOS Drive"—tells you several things about your hard disk without destroying anything. You may even discover free space you never knew you had.

HOW PARTITIONS HAPPEN

Taking a hard disk from its pristine, newly manufactured state to a fully functional DOS or Windows 95 storage area requires three

steps: *physical formatting*, *partitioning*, and *logical formatting*. To understand what each step does, let's take a brief look at how hard disks operate.

Hard disks are mechanical devices consisting of several stacked platters (small, round metal disks treated to store magnetic charges on both sides), a spindle around which the platters rotate (much like the center post on a record turntable), and read and

and SCSI drives have utilities that refresh low-level formats, but IDE drives don't). Low-level formatting essentially gives the disk its physical structure. It adds *tracks*, *sectors*, and *cylinders*, terms with which you're familiar if you've ever had the pleasure of installing a new hard disk.

You can think of tracks as being like the grooves on a long-playing record, although tracks are laid out in separate concentric circles rather than one long, continuous spiral like the grooves on an LP. Tracks are divided into *sectors*, each of which can store a given amount of data, and each platter has its own tracks and sectors. A *cylinder* encompasses all the platters comprising the corresponding track—that is, the track that is the same distance from the spindle—on each. To visualize cylinders, think of a tall

stack of pancakes and a number of drinking glasses, each having a different diameter. Center a glass above the pancakes, then push down right through the entire stack. Then do the same with each remaining glass. The vertical configurations you've produced are cylinders.

Once a hard disk has been physically formatted, it can be divided into physical regions called *partitions*. Each partition occupies a group of contiguous cylinders, and with some operating systems (Linux, for example), you can specify precisely which cylinders you want each partition to occupy. The purpose behind partitioning is to segment your hard disk, for organization's sake and also to let

you run multiple operating systems on a single computer. Each operating system works best (and sometimes *solely*) with its own file system, and only one file system can exist in a single partition. Under some file systems, there's a third reason for multiple partitions: to cut down on wasted space. We'll deal with all these reasons a little later in this article.

Even with your partitions in place, the hard disk is still useless to your computer. To make each partition capable of storing information, it must be *logically formatted*. Where physical formatting gives your disk its physical structure, logical formatting (which is unrelated to physical formatting) provides a means of exchanging data with the operating system by giving the disk a logical structure, the *file system*. When you use the FORMAT command in DOS or the

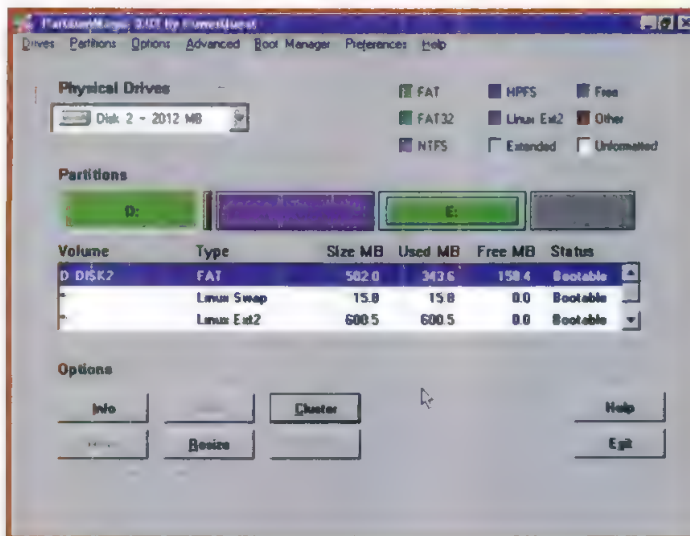


FIGURE 1: This Partition Magic window shows the type and size of each partition and lets you get cluster information.

write heads attached to the disks by a mechanical arm. The read and write heads allow magnetic charges to be stored on the disk (as bits) and retrieved from it. When you direct a program to load a file from the disk, the platters spin around the spindle and the read head moves back and forth over the platters until it locates the desired bits. Software in the hard disk and the hard disk controller then loads the bits into RAM. When you save data, your computer transfers a series of bits to the hard disk, recorded by the write heads as magnetic charges.

From the standpoint of your computer, the hard disk is completely useless until it undergoes the formatting and partitioning stages. The first of these stages is *physical* or *low-level formatting*, which in most cases is handled by the manufacturer (older drives

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256MB to 512MB	8K	4K	8,000	32MB
512MB to 1GB	16K	8K	16,000	128MB
1GB to 2GB	32K	16K	32,000	512MB

FIGURE 2: This table shows roughly the amount of waste you can expect depending on the size of your partition.

Format menu item in Windows Explorer, you are initiating a logical format of either a floppy disk or a hard disk.

The sole purpose of logical formatting is to place a file system on the disk. Your operating system determines what file system is available to you; you rarely get a choice. The most common file systems for machines driven by Intel processors are:

- **FAT (File Allocation Table)**—the standard file system for DOS and Windows. Because of its widespread use, FAT is also accessible by Linux, OS/2, Windows NT, and other operating systems.

- **VFAT (Virtual File Allocation Table)**—a protected-mode version of the FAT file system, used by Windows 95. It is compatible with the FAT system, the main difference being support for long filenames.

- **NTFS (NT File System)**—Windows NT's native file system. You can install Windows NT on a FAT partition, but NTFS is far more advanced, with better security and reliability, faster file access, and very little wasted space.

- **HPFS (High Performance File System)**—OS/2's native file system. As with NTFS, which evolved from HPFS, the security, reliability, speed, and efficiency are far superior to FAT's.

- **FAT32 (32-bit File Allocation Table)**—included with Windows 95 OSR2, a version that is only available preinstalled by the system manufacturer. FAT32 gets rid of many FAT limitations. But so far, it can't be accessed by anything other than Win95 OSR2.

After logical formatting, a partition is also known as a **volume**. Figure 1 shows the file systems on a drive volume. It's a good idea to give volume names to your partitions, which you can do through DOS's LABEL command or with Windows Explorer. Naming your partitions will make them easier to recognize when you use partitioning software such as FDISK, reducing the risk of destroying the wrong partition.

PARTITIONS AND PARTITIONS?

If you've played with FDISK at all, you're probably familiar with primary, extended, and logical partitions. Primary and extended are major partition types, and the total number you can have on your hard disk is limited. You can divide each hard disk into as many as four major partitions, and only one of those can be an extended partition.

Note that these limitations have nothing to do with the operating system. They stem from a decision, made by drive and BIOS manufacturers in the early years of hard disks, that four partitions should be enough for anyone (a bit like DOS's 640K memory limit). The extended partition was developed in response to the need for more than four partitions. An

table in that record. The partition table tells the computer how the disks are partitioned, and the operating system assigns letters accordingly. The designations A: and B: are reserved for floppy disk drives, and the active primary partition (only one can be active) on the first hard disk is assigned C:. Now the first primary partition on each additional hard disk gets the next letter, in sequence. Once the primary partitions on all hard disks have been assigned letters, all the logical partitions on the first hard disk take their turn, followed by all the logical partitions on the second disk, and so on. If you add a new hard disk to a single-drive system that had volumes designated C: and D:, the new disk's primary partition becomes D: and your old D: becomes E:. Note that the OS will assign letters only to partitions it recognizes, so DOS/Windows 95 will ignore an NTFS partition.

WHY DO I WANT MORE THAN ONE?

Most new computers are shipped with a large (1GB or greater) hard disk with only one partition. This causes three potential problems. First, it makes it hard to organize your programs and data, because you end up filling the C: drive with so many directories that finding anything becomes difficult.

Wouldn't it make more sense to have a partition for programs, another for data and downloads, a third for games, and so on? Second, if you want to install an additional OS and want to use the file system native to that OS, you'll have to back up your entire hard disk, delete the existing partition and create new ones, then reformat and reinstall the operating system, programs, and data from scratch. In other words, not likely.

The third problem might come as a surprise. Large FAT partitions waste disk space. That may not seem logical—one big building with multiple rooms seems more efficient than several smaller buildings—but it's true. The problem stems from

the fact that the FAT file system was developed in the days when floppy disks ruled and hard disks were small, and it was never meant to scale onto today's multigigabyte drives. It's extremely inefficient at storing files.

Why? To put it simply, FAT divides its partitions into groupings of sectors called **clusters**. That's fine, except that FAT also limits the number of clusters in a given partition to just over 65,000. As a result, as the size of the partition grows, so does the size of each cluster. For a partition under 128MB, for example, each cluster will be 2K in size, while a

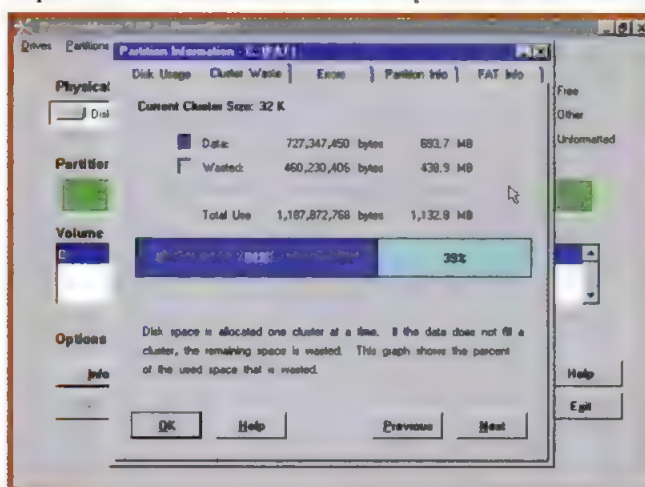


FIGURE 3: Partitioning software shows clearly how much disk space you're wasting with oversize clusters.

extended partition can itself be divided into as many logical partitions as you wish; in a sense, the extended partition acts as a container for them. In a system with multiple operating systems, it's common to have a primary partition for each OS and an extended partition, subdivided into three or four logical partitions, for the OS you use most frequently.

In the DOS/Windows 95/Windows NT world, drive letters are assigned according to partition type. When your computer boots, it checks the master boot record, which is usually on the first sector of the first disk, and reads the partition

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PCTech Tutor

partition between 1GB and 2GB has a relatively huge cluster size of 32K. And it's not as if you have a choice; that 32K cluster size is the *minimum* for a 1GB partition, again because of the limited number of clusters the partition can have.

FAT allocates disk space to files using whole clusters, even though very few files are precise multiples of the cluster size. The data occupying a file's last cluster may fill the cluster completely, or it may be as little as a single byte. With an even distribution of file sizes, the average wasted space per file will be half a cluster. On a 127MB drive with 2K clusters, your CONFIG.SYS file, typically about 0.5K in size, wastes 1.5K. The same file on a 1.2GB drive with 32K clusters wastes 31.5K. On that same 1.2GB drive, a 100K file occupies just over three 32K clusters, with the majority of the fourth cluster remaining empty. Figure 2 shows roughly how much wasted space you can expect.

HELP WANTED

As the table clearly shows, small partitions mean less wasted space. It's a no-brainer, then, right? Fire up FDISK and go to it. But as we've already discussed, that's a lot of work. Who has a couple of evenings to spend backing up and restoring data and reinstalling programs?

That's where third-party partitioning software comes in. The most common packages are PowerQuest's PartitionMagic and Quarterdeck's Partition-It, both of which do much the same thing. Their primary role is to let you change the size of a partition without destroy-

Third-party partitioning software lets you change the size of a partition without destroying the data in it.

ing the data in it, but they can do much more. Each package also includes a utility for moving applications from one partition to another, adjusting system references as necessary. At first, they're a bit terrifying for FDISK veterans, who tend to think of partitioning as destroying data, but they work well.

I used PartitionMagic extensively while researching this article. The program analyzes

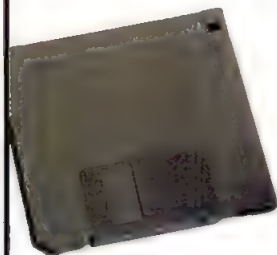
your partitions and calculates wasted space (see Figure 3) and lets you resize and move your partitions by sliding your mouse pointer along a bar. It works with FAT, FAT32, NTFS, and HPFS partitions, and it lets you resize clusters on the fly. It even deals with changed drive letters by remapping system references to existing applications. Its most impressive moment, however, comes after you've completed your work, when it tells you how much of your hard disk you've reclaimed.

PASSING THE MANTLE

This is my first Tutor column. For the next few months, I'll be attempting to fill the rather daunting shoes of Jeff Prossie, who is taking a well-earned leave of absence to concentrate on other projects. My attempt at shoe-filling will consist of explanations of how things work and how you can make them work for you, and to do so I'd like to enlist your help. I'm inviting you to send me e-mail (at nrandall@sprynet.com) with suggestions for future Tutor articles or comments on current columns. I look forward to hearing from you. □

Neil Randall is the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage (Que)*.

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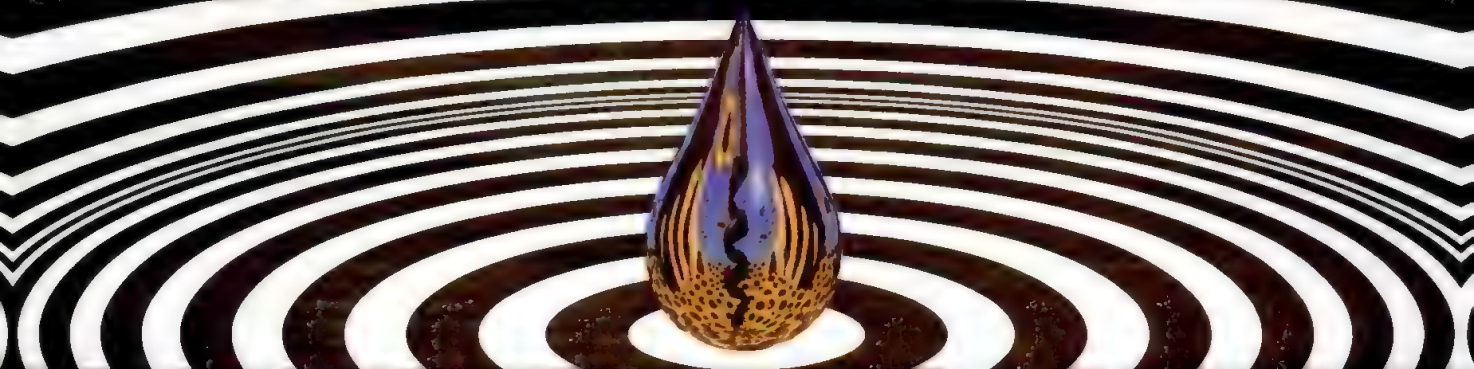
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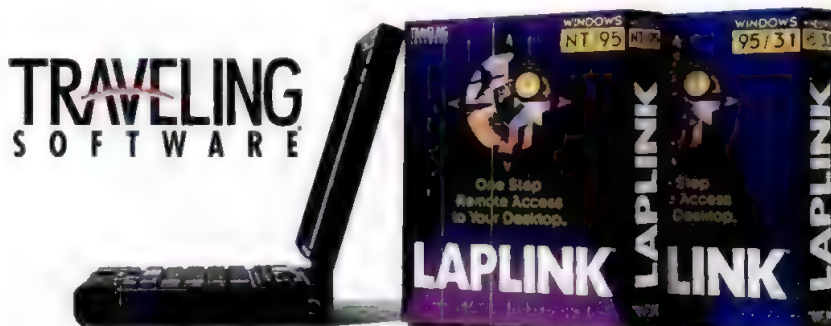
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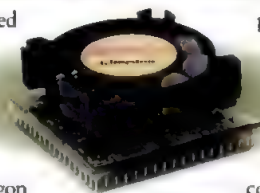




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BigBin Enhances Your Recycle Bin

With BigBin, even files deleted under DOS are sent to the Recycle Bin.

By Rick Knoblauch

The Windows 95 Recycle Bin is an excellent repository for deleted files. When you delete a file using the Explorer, it's always with the serenity of knowing you can later scroll through the Recycle Bin contents, purging or restoring those files that you've put out to this binary pasture. But, alas, if you like to perform file maintenance at the good old DOS prompt, you can't take advantage of the Recycle Bin, because only files removed from within Explorer get that special treatment.

This issue's utility, BigBin, solves this dilemma. BigBin eavesdrops on Windows 95 file operations and routes files deleted from within DOS boxes to the Recycle Bin. It doesn't really make the Recycle Bin bigger, just potentially more full, depending on how much time you spend in DOS.

You can obtain BigBin by downloading it from PC Magazine Online or by mail. Refer to the sidebar "Getting the Files" for details. The source code for BigBin, which was written in C and assembler, is also provided for those interested in seeing how it works.

USING BIGBIN

To install BigBin, copy the program files, Bigbin.exe and Functrap.vxd, to a subdirectory on your hard disk. You can also add a shortcut for BigBin.exe to your Startup group so it loads automatically each time you start Windows 95.

When you execute BigBin, it installs itself on the system tray, where it sits quietly rerouting file deletions. To exit BigBin and revert back to the normal behavior for DOS-based deletions, right-click on the BigBin tray icon and select Exit Program from the menu.

In general, BigBin uses whatever properties you've set in the Recycle Bin's Properties

dialog, which you access by right-clicking on the Recycle Bin and selecting Properties. Here you'll see a check box that controls whether to display a delete-confirmation dialog, along with controls to bypass the Recycle Bin entirely (immediate removal on delete), and set the maximum percentage of disk space that the Recycle Bin can use. You can set the latter two options globally or separately for each drive.

By default, BigBin does not prompt you for confirmation of deletions from DOS boxes,

BigBin

BigBin enhances the Windows 95 Recycle Bin so that files deleted from within DOS boxes are protected along with those deleted through Explorer.



regardless of your settings in the Recycle Bin's Properties page. This is because the confirmations can be intrusive. For example, if you're using the DOS-based EDIT utility, a delete confirmation will be generated each time you save a file. Also, the confirmation dialog is graphical, so if you're in a full-screen DOS session, Windows will switch you out to present the dialog.

If you are running in a windowed DOS session, the confirmation is less intrusive (see Figure 1). You can turn on DOS delete confirmations by using the *R* switch to instruct BigBin to use the Recycle Bin confirmation set-

ting. Invoke BigBin with the *R* command line parameter as follows:

BigBin R

If you have configured the Recycle Bin to confirm deletions and you use the *R* switch, deletions from DOS boxes will be confirmed in addition to deletions from Explorer.

INSIDE BIGBIN

To accomplish its magic, BigBin needs two pieces: (1) a VxD for the low-level job of tapping into the file system, and (2) an application program for loading the VxD, directing it to do its work, and making use of applications-level services. The VxD, called functrap.vxd, is written in assembly language using Microsoft's MASM 6.11 and the Windows 95 DDK. The application program, called bigbin.exe, is a 32-bit C program that was developed using Microsoft's Visual C++ 4.0.

The implementation of these components offers insights into dynamically loading VxDs, communicating between an application and a VxD, Windows 95 installable-file-system manager services, the SHFileOperation function, and techniques for coordinating the efforts of multiple threads. I'll discuss each of these areas, and in the process, I'll also mention some reference materials you may want to explore for further information.

LOADING THE VXD

BigBin makes use of a dynamically loaded VxD. Recall that prior to Windows 95, VxDs had to be loaded via the SYSTEM.INI file, in much the same way as DOS device drivers relied on CONFIG.SYS for their genesis into the system. Windows 95 and its Plug and Play capabilities changed all that, as drivers needed to be able to come and go to support on-the-fly hardware configuration changes.

Bigbin.exe dynamically loads functrap.vxd by adding a special prefix to the pathname passed to the CreateFile Win32 API function, as follows:

```
#define VXD_NAME  
"\\\\.\\functrap.vxd"
```

FOR PROGRAMMERS ONLY BigBin enhances the Recycle Bin so that files deleted from within DOS boxes are protected along with those deleted through Explorer. It was written in C and assembler. The full source code for BigBin is available from PC Magazine Online. It demonstrates the following programming techniques:

- dynamic loading of a VxD;
- communication between an application and a VxD; and
- sending files to the Recycle Bin using the SHFileOperation function.

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```
HANDLE vxd_handle;
```

```
.
.
.
vxd_handle = CreateFile
(VXD_NAME,
0, 0, NULL, 0,
FILE_FLAG_DELETE_ON_CLOSE,
NULL );
```

The prefix "\\.\\" (each backslash is doubled above because this is a C program) tells CreateFile that we want to load a device driver versus actually creating a file. If the driver is found in the current search path, it is loaded and a handle is returned that BigBin uses for further conversations with the VxD. Otherwise, CreateFile returns -1. The FILE_FLAG_DELETE_ON_CLOSE parameter indicates that the VxD should be unloaded when all the handles that reference it are closed.

As functrap.vxd is being loaded, it receives the SYS_DYNAMIC_DEVICE_INIT message, a system control message that is part of the Windows 95 support for dynamically loadable device drivers. This is the stage wherein VxDs typically set up interrupt service routines, hook into system services, and perform other initialization. Functrap responds to this message by hooking the Windows 95 installable-file-system manager's API functions. This is readily accomplished, as the IFS manager provides a convenient service, IFSMgr_InstallFileSystemAPIHook, for doing just that. Functrap calls this service, passing the address of its hook procedure as an argument. The IFS manager places this in its list of API function hooks and returns the address of the previous

quest, the drive being accessed, a pointer to an IFS I/O request structure, and other information. With this hook in place, Functrap can observe file system operations such as OPEN, CLOSE, and, most importantly, DELETE.

For more information on this topic and just

```
struct trap_criteria {
DWORD tc_func_num; //function app wants trapped (-1 = all)
DWORD tc_drive; //drive (-1 = all drives)
DWORD tc_proc_handle; //process (-1 if all processes)
DWORD tc_vm_num; //VMs (-1 if all) (0xffffffff if only DOS)
WORD tc_status; //error code (-1 if all status)
DWORD tc_callback; //address to call back
WORD tc_misc; //misc flags for logging VxD (bit 0=disable
//logging, bit 1=fake the operation, bit 2=
//fake the operation and wait until we've
//acknowledged the callback (and the status)
};
```

FIGURE 2: BigBin uses the trap_criteria structure to tell the VxD which IFS manager API function to trap, the conditions under which to trap, and the address of a callback procedure within BigBin.

about anything else you may want to do at the systems level of Windows 95 (including all the techniques I've described involving VxDs), check out Walter Oney's book *Systems Programming for Windows 95* (Microsoft Press, 1996). It's an invaluable source of knowledge.

THE IOCTL INTERFACE

Although Functrap listens in on all of the IFS manager API function activity, it only passively eavesdrops unless BigBin directs it to take more action. This is because Functrap has been designed as a generic IFS-function-monitoring engine. (In fact, another utility planned for a future column will also interface with it.)

BigBin makes use of the DeviceIoControl API function to send messages to the VxD via the IOCTL interface. The device handle previously received from CreateFile is passed, along with an I/O control code and pointers to input and output buffers. The I/O control code tells the VxD what function to perform. In general, these values are meaningful only to the VxD and its application counterpart, but there are a few exceptions. A value of 0 is sent

values can be defined by each VxD.

Calling the DeviceIoControl function causes a W32_DEVICEIOCONTROL message to be sent to the VxD, which in turn performs the appropriate function per the I/O control code. BigBin calls DeviceIoControl, with a

program-defined control code value of 2 and with a structure called trap_criteria (see Figure 2). This structure tells the VxD which IFS manager API function to trap, the conditions under which to trap, and the address of a callback procedure within BigBin.

As you may have guessed, the file system function BigBin specifies is IFSFN_DELETE. That gives BigBin control when files are deleted, but how can this be limited to only files deleted from within DOS boxes? The answer lies in the trapping conditions that BigBin stipulates in the trap_criteria structure entries. Among these is tc_vm_num. A tc_vm_num value of -1 says to apply the conditions to all virtual machines. A value of -2 (the one used by BigBin) says to apply the conditional trapping to IFS functions that occur in virtual machines with ID numbers greater than 1, which is where all DOS boxes reside.

Functrap processes the IOCTL request by storing this information, and it also uses the Get_Cur_Thread_Handle VMM service to note the thread handle of the thread within BigBin that issued the request. It is needed later when Functrap performs the callback into BigBin.

A DEDICATED THREAD

BigBin utilizes two threads: its initial main thread of execution, and an additional thread that it creates and dedicates to the job of receiving and processing callbacks from the VxD. The second thread is created using the C runtime library function, _beginthreadex. Once started, the thread makes the DeviceIoControl call to the VxD establishing the callback, then puts itself into an alertable wait state anticipating notifications of file-delete

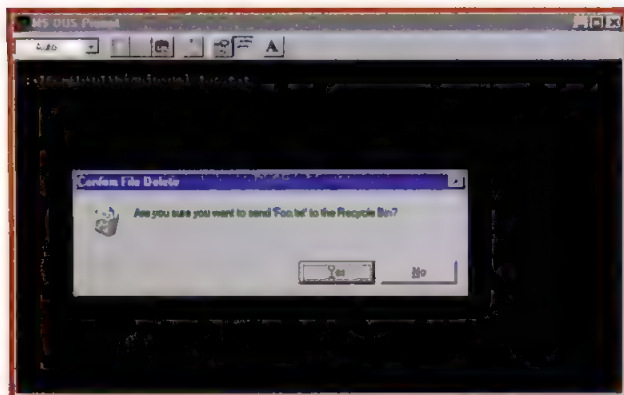


FIGURE 1: The confirmation dialog box is graphical, which is less distracting in windowed DOS sessions. BigBin turns off confirmation-prompting by default, since it's distracting in full-screen sessions.

hook (one will always exist, even if it's simply a default function within the IFS manager).

When IFS Manager API function calls occur, installed hook procedures are called with parameters indicating the type of re-

quest when the VxD is being dynamically loaded to determine if it supports the IOCTL interface, -1 is sent when the handle is closed, and 1 is often the code that applications use to request the VxD's version number. Any other

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```
DWORD __stdcall do_getcalls()
{
    //Set up the callback with the VxD (note: VxD will get the
    //ID for this thread and use it and the callback address to
    //inform us about file deletes).

    DeviceIoControl(vxd_handle, VXD_REGISTER_CB, &trap_cond,
        (sizeof(struct trap_criteria)), &condition_handle,
        sizeof(condition_handle), NULL, NULL);

    while( WaitForSingleObjectEx(stop_flag,
        INFINITE, TRUE) == WAIT_IO_COMPLETION)
    ;

    return 0;
}
```



FIGURE 3: BigBin's worker thread sets up the callback with the VxD, then waits for the VxD to inform it of a file deletion.

operations (see Figure 3). A thread waits in an alertable state after it has submitted an asynchronous I/O request, such as ReadFileEx, and is ready to receive notification of the I/O completion—or when (as in this case) it expects to be called back via an asynchronous procedure call (APC), which is the mechanism

Functrap uses to perform the callback.

The first parameter in the while statement shown in Figure 3 is a handle to an object that controls the waiting. When the function is executed, it enters a very efficient wait state where it will stay until one of three things happens: the object has “signaled,” a time-out expires (see

the second parameter), or I/O has completed.

Each type of object reaches the signaled state in a different way. In this case, completion is signaled by stop_flag, which is a handle to an event object created by BigBin's main thread. When it's time to stop (that is, the application is being closed), the main thread calls the SetEvent function to signal the event. The function being executed by the thread returns, and the loop finally exits, effectively terminating the thread.

If the time specified in the second parameter (in milliseconds) passes with no signal, WaitForSingleObjectEx returns WAIT_TIMEOUT. The value INFINITE used here means the function will never time-out. The third parameter is a BOOL that indicates whether the wait is “alertable.” Specifying TRUE causes the function to return when the system queues an I/O completion routine or an APC (as will occur in this case).

THE VXD CALLS BACK

When Functrap observes a file-delete operation, it uses the VWIN32 service, _VWIN32_QueueUserApc, to perform the callback. (VWIN32 is a Win95 VxD that supplies services involving thread scheduling and synchronization.) Functrap calls the service as follows:

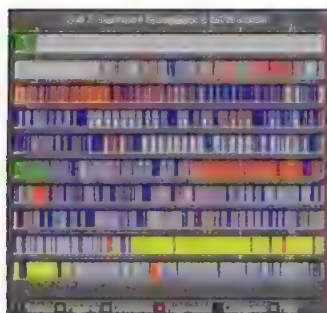
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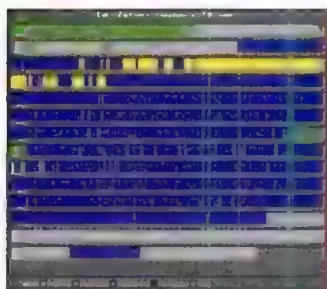
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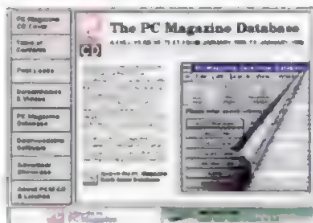
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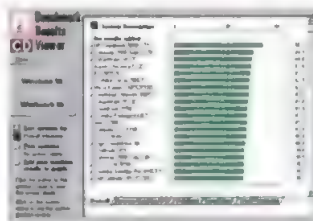
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```
;ptr to conditional trapping info
mov     edx, [ebp].condition_ptr

;get BigBin's callback address
mov     eax, [edx].tc_callback

;its thread handle we previously
;stored
mov     ecx, [edx].tc_thread

;ptr to buffer containing file path
mov     edx, [ebp].rec_buffer

VxDCall _VWIN32_QueueUserApc <eax,
edx, ecx>
```

This queues an APC to BigBin's worker thread. The callback takes place the next time the thread is scheduled by the operating system.

SHH! BIGBIN IS WORKING

Finally, the IFS file-delete function has been intercepted, and BigBin has been informed of this event by a callback to the function `our_callback`, which takes as its argument a pointer to a structure that contains the fully specified filename. The `our_callback` function, in turn, calls the functions `send_to_recycle` and `release_rec` (available for downloading from PC Magazine Online), which send the file to the Recycle Bin and then release the resources associated with the callback.

Files are sent to the Recycle Bin by means of an API function new to Windows 95 called `SHFileOperation`, which allows applications to move, copy, rename, or delete files. The disposition of the files deleted with this function is controlled by flags that you can set in the `SHFILEOPSTRUCT` structure, passed as parameters into the function. For example, `FO_DELETE` tells Win 95 that the file is to be

deleted by sending it to the Recycle Bin. `FOF_ALLOWUNDO` causes the information required to undelete a file to be preserved.

Meanwhile, Functrap can't return from the `IFSN_DELETE` function until the file is "deleted," so it simply blocks until the queued callback executes and completes the `SHFileOperation` processing. To block, Functrap uses the `IFSMgr_Block` service, which puts it to sleep until `IFSMgr_Wakeup` is called. Both of these calls take as a parameter a 32-bit key value that uniquely identifies the blocked code and associates the right wake-up with the corresponding blocked code. Functrap must allocate a buffer record to house the filename of the file being deleted (and other information it reports back to BigBin); it uses the address of this buffer record as the unique key.

The last piece of the puzzle is how the wake-up call ever gets initiated. There's actually one more IOCTL code that BigBin issues to the `VxD`. When the `SHFileOperation` function completes, BigBin uses this code to report back the status and also inform Functrap that the buffer will no longer be needed. In response to this, Functrap deallocates the buffer and wakes up its `IFSN_DELETE` monitoring code, which has been in progress. This code causes the final intended destination of the `IFSN_DELETE` function to be routed to an empty routine (after all, the file will no longer be present), and it returns a status reflecting the success or failure of the delete as performed by `SHFileOperation`. That's all there is to it.

SAYING GOOD-BYE

Recall that when BigBin loaded Functrap, the `FILE_FLAG_DELETE_ON_CLOSE` parameter was specified in the `CreateFile` API function call. This causes the `VxD` to be unloaded when all the handles that reference it are closed. In

the `shut_down` function (available on PC Magazine Online), BigBin finishes up its business by closing the handle to Functrap. There's only one problem with this: If another utility (such as the one planned for a future Utilities column) also has an open handle to Functrap, it won't be unloaded. Since Functrap will still be running, faithfully reporting on IFS manager API function activity, BigBin must also instruct it to cancel the callbacks (otherwise it will attempt a callback to a nonexistent application). To avoid that situation, BigBin uses a `DeviceIoControl` call once again, this time with an IOCTL code instructing Functrap to update the criteria under which IFS manager API functions are monitored. In the `trap_criteria` structure, bit flags (`APP_EXITING` and `DISABLE_LOGGING`) instruct Functrap to refrain from future callbacks. Once the callbacks are disabled, BigBin closes its handle to Functrap.

The `shut_down` function also calls the `SetEvent` function to signal the event, which causes the worker thread to exit its wait loop. The function being executed by the thread returns, effectively terminating the worker thread. And, finally, `shut_down` removes all visual remnants of BigBin by calling the `Shell_NotifyIcon` function with the `NIM_DELETE` parameter. This removes BigBin's icon from the system tray.

Like wearing a favorite, well-worn pair of shoes, using the familiar C: prompt is a hard habit to break. Now, with BigBin, the C: prompt can perform the job of deleting files as proficiently as the fancy GUI world from which it's launched. □

Rick Knoblaugh is a systems programmer and a frequent contributor to PC Magazine.

Sheryl Canter is editor of the Utilities column and a contributing editor of PC Magazine.

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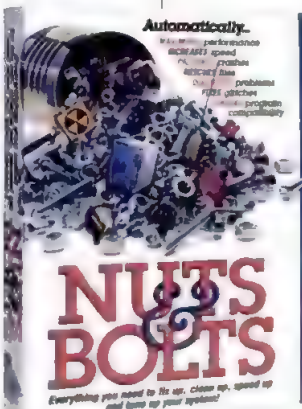
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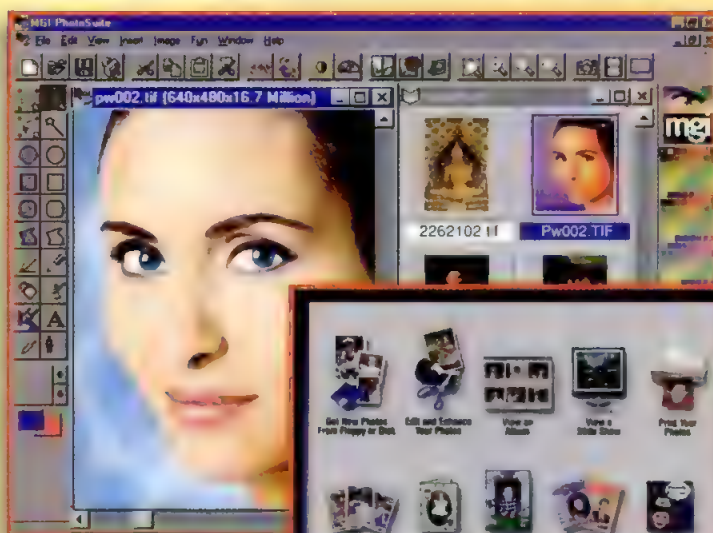
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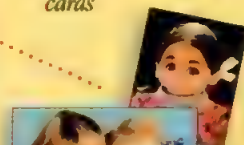
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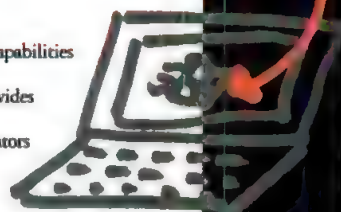
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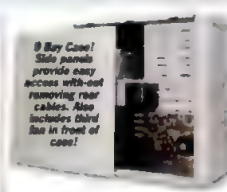
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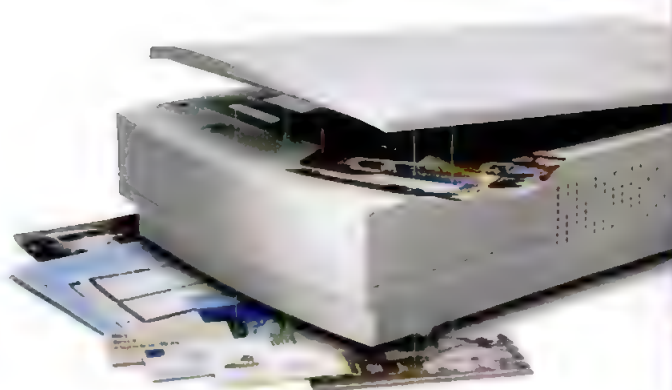
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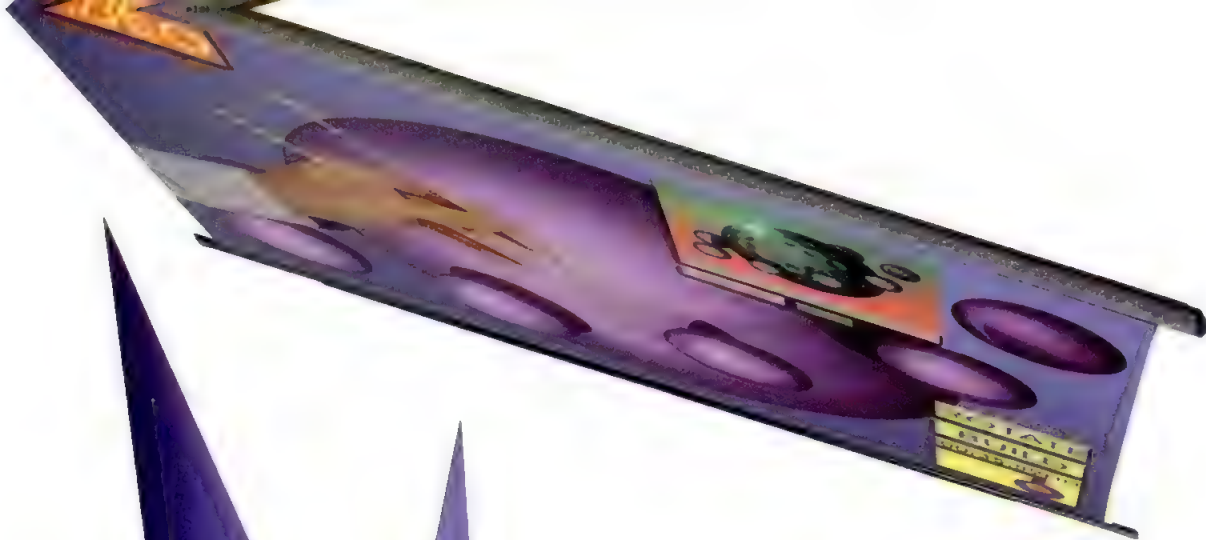
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MONITOR	TUBE SIZE (Viewable size)	P-TCH (mm)	1600 HORIZONTAL PIXELS?
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SONY 17SEH	17" (16.0")	0.25 AG	NO
HITACHI ELITE 751	19" (18.0")	0.22 horiz.	YES (1672)
SONY 20SFH	20" (19.1")	0.30 AG	NO
VIEWSONIC GT800	20" (19.1")	0.30 AG	NO
MITSUBISHI 91TXM	21" (19.7")	0.28 AG	NO

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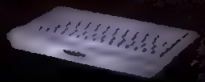
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User-to-User

BY NEIL J. RUBENKING

Perfect Sizing for Explorer Columns

I just discovered a convenient feature of Windows 95 I haven't seen published anywhere. Most people know that in Explorer's detail view, you can change the width of a column by dragging the column heading separator on the right side of the column. I was doing this once when by accident my finger twitched and double-clicked. The column suddenly jumped to a different width. I played with this for a minute, and I discovered that double-clicking the separator line autosizes the column to the data in the column!

DANIEL JAMESON
Los Angeles, California

PC MAGAZINE: The Windows object that Explorer uses to display file details is called a list view, and it's used in many programs besides Explorer. Once you know about this feature, you'll find it everywhere. Any time you find a list view in a Windows 95 or Windows NT 4 program, give this tip a try. It's better than resizing the columns by hand, because it adjusts to fit the largest item in the column, whether or not the item is visible at the time.

The Case of the Missing Drives

When my 420MB hard disk was almost full, I ran DRVSPEC to compress the data and buy some time. Finally I decided to add a new 2GB hard disk and to split the new disk into a 1GB and two 500MB partitions. I backed up my data, reinstalled Windows 95, and restored it, with professional help. But when Windows 95 was up and running again, not all of my drive letters were visible.

I tried Safe Mode and almost jumped for joy when it seemed that all the drives were there. In that mode, all the drives and partitions (C, D, E, F, and G) were visible except for the CD-ROM drive (H). When I rebooted into normal mode, however, the system showed C, D, E, and F, but not G and H.

I finally got the solution from Microsoft. The problem resulted from the fact that I had a compressed drive when the reinstallation project began, and as far as the Registry was concerned, I still did. Apparently, the installation process doesn't clear the Registry of the old information. To fix this, run RegEdit. Click Edit | Find and type "NoDrives" to

locate this key. The number to the right of NoDrives should be all zeros. In my case it was a hexadecimal number that translated to decimal 192. To set the number to 0, right-click on the icon to the left of NoDrives, then click Modify, enter 00, and click OK. After I did this and rebooted, all of my drives were visible. One note of caution: Be very careful when editing the Registry file, because one false move could result in having to re-install Windows.

JAMES WARE
Stockton, California

PC MAGAZINE: I had originally put this item aside, thinking that the problem it describes must be very uncommon. Then it happened to me! I added a second hard disk with four partitions, and I found that one of the new partitions and my CD-ROM drive failed to appear in Explorer. Sure enough, the data for the NoDrives value was nonzero. I changed it to zero and restarted the system, and my drives reappeared.

It's conceivable, of course, that your Registry may contain more than one value named NoDrives. Check the status line of RegEdit after a successful search for NoDrives; it should indicate that the key is HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer.

The NoDrives value isn't documented anywhere, but its purpose can be deduced. When you compress an entire drive, DriveSpace gives the host drive's original drive letter to the compressed drive and assigns the host drive a new letter, several letters past the last letter actually in use. For example, if you compress all of drive C: and the last actual drive is D:, the host drive might get assigned the letter I:. When Windows steps through the list of drives, it has to skip the letters between D: and I:. It appears that each bit in the NoDrives Registry value represents a drive letter, and a set bit means the drive should be ignored. The value 192 expressed in binary format is 11000000. Considering the rightmost 0 as A: and working leftward, you'll find that the two bits that are set to 1 repre-

sent G: and H:, which are precisely the drive letters that were suppressed!

Free Secret Update for Dial-Up Networking

The Microsoft ISDN 1.1 Accelerator Pack (msisdn11.exe) includes an updated Dial-Up Networking utility, which will allow the profile to run immediately without your having to click OK at the Connect To window. You simply open Dial-Up Networking, choose Settings from the Connections menu, and then disable "Prompt for info before dialing" by clearing the check mark. The new Dial-Up Networking also incorporates the same functions as Scripter.exe did—for example, linking a Dial-Up Networking profile to a script, stepping through a script, and so forth. During installation, Scripter.exe is deleted without warning.

You can download the ISDN 1.1 Accelerator Pack from www.microsoft.com/windows/software/isdn.htm; you don't have to have ISDN to install it. If you want to delete the ISDN utilities, open Control Panel, open Add/Remove Programs, click on the Windows Setup tab, and click on Communications | Details; then click on the check mark for Microsoft ISDN 1.1 Accelerator Pack to deselect it, on the OK button to close the Communications window, and on the OK button to initiate

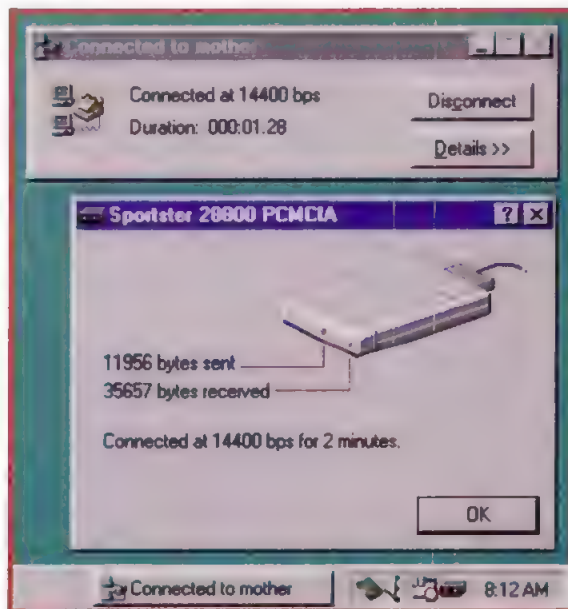


FIGURE 1: The Dial-Up Networking applet that comes with Windows 95 displays the connection duration and sent/received statistics in separate windows.



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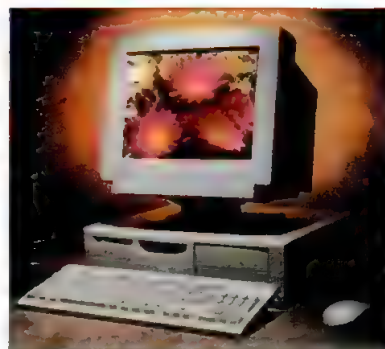
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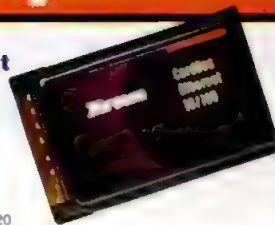


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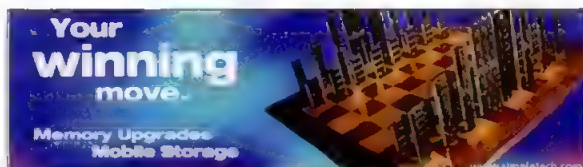
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	32MB	\$278.00	74918			
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	32MB	\$268.76	62467	64MB	\$477.90	62468
ProLiant 2900	32MB	\$278.41	79833	64MB	\$384.25	79834
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Satellite 100, 105, Satellite Pro 400, 410 series	8MB	\$97.24	63086	16MB	\$187.16	63087
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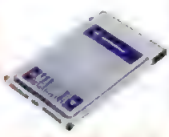
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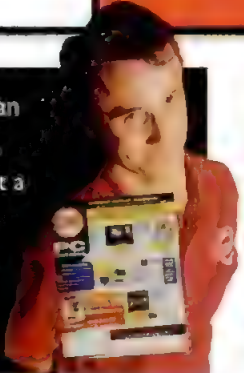


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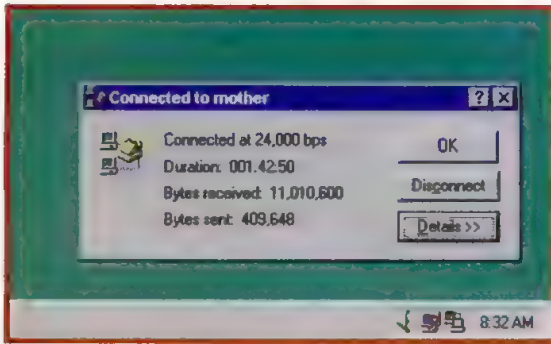


FIGURE 2: The enhanced Dial-Up Networking applet shows the connection's duration and statistics in a single window and lets you connect without prompting.

the removal of the ISDN Accelerator Pack. The new Dial-Up Networking will not be removed.

NIKI CHIN
via the Internet

PC MAGAZINE: With the original Windows 95 Dial-Up Networking applet, the active connection's status is displayed in a small window that automatically minimizes to a Taskbar button. The modem's status is reflected in a tray icon of a modem, with lights that flash to indicate data sent and received. Opening the modem icon yields a larger window that reports the number of bytes sent and received in the current session. Figure 1 shows the on-screen representation of a connection made using the old Dial-Up Networking applet.

These two displays are combined into one (Figure 2) when you install the new Dial-Up Networking, as described here. The active connection is represented by a tray icon picture of two computers that flash to indicate data sent and received. Opening this icon brings up a window that reports the connection's status as well as bytes sent and received. When you add this new streamlined display to the convenience of connecting without being stopped for confirmation, you'll surely find this update worth the download.

Deleting "Bad" Files

Occasionally users of our network manage to create files with reserved names (for example, LPT1 or COM2) in their home directories. The files at first seem to be impossible to remove or rename using conventional commands, but I've discovered how to delete them using the following Universal Naming Convention (UNC) syntax:

```
del \\.\c:\fullpath\filename.ext
```

This method works as well across the net-

work as on a local machine, which is fortunate, since I haven't been able to get it to work with OS/2 Warp. But when I issued the command from a Windows NT client, one of our IBM LAN servers happily deleted the offending file.

ULF WESTLUND
Stockholm, Sweden

PC MAGAZINE: If your system is network-enabled, regardless of whether it's actually connected to a network, you may be able to use this tip to delete "impossible" filenames—or to create them!

Here's how you can test whether your particular system supports UNC filenames. First, enter this command:

```
ECHO Top Secret! > \\.\c:\nul.txt
```

If you don't get a "File creation error," enter this command next:

```
TYPE \\.\c:\nul.txt
```

This should display the contents of the file NUL.TXT.

On a system whose network support enables this kind of file access, users can accidentally create files whose names match those of DOS devices. To rename or delete these files, simply prefix the full pathname with two backslashes, a period, and a backslash. As the example commands show, you can use this technique to provide a small degree of security. If you are storing secret data in a hidden file whose name is normally invalid, only someone who knows this secret will be able to read it.

Make Your Own Icons for Windows 95

Did you know you can easily create your own icons using only the tools you already have at hand? Simply bring up the Paint accessory, select Attributes from the Image menu, and type in 32 high and 32 wide (this is the number of pixels). Then zoom in to around 800 percent by selecting Zoom from the View menu and clicking on Custom. Now you can draw a little picture of whatever you like. Click File | Save, then type in a filename with the extension .ICO (this is important; Paint will otherwise assign the file the extension .BMP, and the Change Icon box won't recognize it).

Now open the Properties box for a shortcut, and select Change Icon. Type in the path and name of your picture and click OK, and

voilà! Your picture appears as a standard 32-by-32 icon!

Note that while you can edit this icon again in Paint, you can't edit icons that are embedded in programs. You have to use a proper icon editor for that.

CRAIG A. SMITH
Auckland, New Zealand

PC MAGAZINE: The fact of the matter is, when you follow this procedure you are not actually creating an .ICO file. Windows 3.x rejects the resulting file, and an actual icon editor won't load it. The reason the technique works is that Windows 95 is flexible enough to accept a bitmap of the right size, in place of an actual icon.

An actual .ICO file contains an image bitmap and a separate mask bitmap that serves to define transparent areas. The background shows through all transparent areas, making possible icons that have varied shapes even though they are constructed on the same square grid. You can't add a transparency mask to a bitmap icon created using Paint. But when loading this type of



FIGURE 3: Windows 95 checks the top-left pixel of the icon-shaped bitmap and treats all pixels of that color as transparent; you can see the background pattern around the face and behind the eyes.

image, Windows 95 checks the color of the top-left pixel and treats all pixels of that color as transparent. Figure 3 is an enlarged image of such an icon. The area outside the circular face (including the top-left pixel, of course) and the area inside the eyes were bright green in the original bitmap. As you can see, when the bitmap is used as an icon, the background shows through these areas.

This technique almost works in Windows NT 4 as well. The one problem involves transparent areas. Instead of treating pixels matching the top-left corner as transparent, Windows NT 4 seems to display them as black.

Ask Our Advisors

HARDWARE

Gold Peg, Tin Hole

I've been told to use matching metal leads for SIMMs and plug-in slots. That is, one should not use gold leads with nongold slot connections, because dissimilar metals may tend to corrode or form oxides, possibly causing memory problems. Is this really a significant problem? SIMMs with tin leads do not always seem to be available.

JOHN CHIN
via the Internet

PC MAGAZINE: We discussed this subject in a Second Looks article, in our issue of April 9, 1996, and the advice remains the same: Avoid mixing tin and gold connections.

There are a number of factors involved. One is the simple fact that when different metals come into contact with one another, a galvanic reaction occurs that causes the connection to corrode. You may have seen the effects of this on antique tableware, where a steel knife blade is mated with a silver handle.

Another reason is a result of the two metals' different physical characteristics: The gold can scratch the tin, creating an uneven surface that produces a less effective electrical connection.

While gold is not susceptible to oxidation, tin surfaces can form oxides. When mated with gold, these oxides can be deposited on the gold surface, also diminishing the electrical connection.

Some people point out that these reasons are small and, under most conditions, proceed quite slowly. As most people keep a computer for only three to five years, it is entirely possible that gold and tin can be used in contact with each other without your encountering problems. But humidity, dirt, and oil can accelerate the effects, so make sure the components are clean when you assemble them, and keep humidity down.

Of course, the best solution is to avoid the problem entirely. Match your SIMM sockets to your SIMM so that you have gold-to-gold or tin-to-tin connections.—*Alfred Poor*

OPERATING ENVIRONMENTS

Removing Windows NT Boot Manager

How can I get rid of the Windows NT boot manager? I installed Windows NT Server 3.51 on a Windows 95 machine but then decided to

put it on a separate computer and erase it from the first machine. Whenever I boot the Windows 95 machine I still get the Windows NT Boot menu. Short of reformatting the hard disk and reinstalling the operating system, can you tell me how to get my machine to stop looking for a nonexistent Windows NT system?

BASIL HONIKMAN
via the Internet

PC MAGAZINE: The official way to remove Windows NT is to run the install program Winnt.exe with the /D switch. But since you've already wiped out most of Windows NT, that won't help. You need to remove the Windows NT boot sector. Boot into Windows 95 and create a bootable floppy disk on a blank disk using the SYS command. Copy the Sys.com program to this disk. Now boot from the disk and use the command SYS C: to copy the Windows 95 system files to the C: drive. Finally, you can delete the (possibly hidden) files Pagefile.sys, Boot.ini, Ntldr, Ntdetect.com, and Ntbootdd.sys if they are present.—*Neil J. Rubenking*

WORD PROCESSING

Replacing Ami Pro Bullets, Revisited

In the Ask Our Advisors column of September 24, 1996, Nathan R. Strahl asked how to find and replace bullets entered in Ami Pro with the Edit | Insert | Bullet command. M. David Stone showed how to open the Ami Pro document as a text file to find and replace the codes for the bullets. There's another way to approach this problem, if you enter the bullets differently in the first place.

Instead of using the Edit | Insert | Bullet command, use the Windows Character Map utility. To insert a bullet, load Character Map and select the same font in the Character Map's Font box as the one you're using in your document. Within Character Map, double-click on the character you want to use as the bullet. Character Map will add the character in its Characters to Copy text box. Choose the Copy button to copy the character to the Clipboard. Next, return to your Ami Pro document and paste the character into the document. To use the same bullet again, you can copy and paste it from within the document as needed.

The extra work involved in using Character Map instead of the Edit | Insert | Bullet command pays off when you need to change bul-

lets. To replace the bullets, first find out the codes for the character you want to replace and the one with which you want to replace it by opening Character Map, selecting each character, and noting the ANSI code for the character in the lower-right corner of the Character Map window. The codes will take the form Alt-0nnn, where nnn is a number between 129 and 255.

Once you know the codes, you can use the Edit | Find and Replace command, entering the ANSI codes in the Find and Replace text boxes. To enter the codes, make sure that NUMLOCK is on and hold the Alt key down as you type the numbers. Be sure to include the leading 0—without it, Windows will use the IBM higher-order character set instead of ANSI characters.

JOHN L. CORBITT
Lilburn, Georgia

PC MAGAZINE: I received a lot of feedback concerning the original tip. All of the comments suggested using an alternative to the Edit | Insert | Bullets command. As such, they would not have solved Mr. Strahl's need to change bullets in already existing documents,

OUR ADVISORS

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M. David Stone is a contributing editor and the coauthor of *Word for Windows Companion, Second Edition*.

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hp HEWLETT PACKARD *Pavilion*

intel
inside
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HP Pavilion Multimedia

Model	CPU	RAM/HD	CD	Price
7125	133MHz	16MB/1.6GB	6X	\$899*
7320	166MHz MMX	16MB/2.1GB	16X	1799
7360	200MHz MMX	32MB/3.8GB	16X	2299

* Factory Refurbished

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Model	Size	View	Resolution	Price
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pentium

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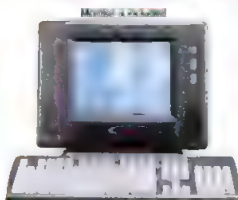
Model	Description	Part #	Price
Hewlett-Packard			
7125	P133, 16MB, 1.6GB, 6X	D3877A#ABA	\$899†

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Model	Description	Part #	Price
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Toshiba			
7160	P166, 16MB, 1.9GB, 8X	DT7160U-06AB	\$999†
Packard Bell			
D141	P133, 24MB, 1.7GB, 6X	845007	\$999
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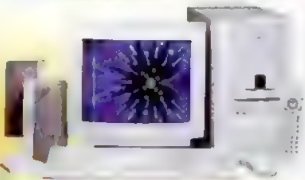
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NEC

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but the alternatives are worth knowing if you're an Ami Pro user who isn't ready to upgrade to Word Pro.

The most common suggestion was to modify and use one of the default bullet styles in Ami Pro or define a new one. Ami Pro's default style sheet includes a Bullet style and a Bullet 1 style. If you format a paragraph with either of these, Ami Pro will add a bullet to the paragraph automatically. If you then modify the style—by choosing Style | Modify, then choosing Bullets and Numbering, and redefining the bullet—Ami Pro will change the bullets for the style throughout the document.

Mr. Corbitt's approach takes more work, but it also opens the door to a wider variety of bullets. And you can cut down on the work substantially by adding the bullets to a glossary file.

Note that contrary to Mr. Corbitt's instructions, you don't have to limit yourself in Character Map to the same font you're using in your document. You can just as easily pick Symbol, Wingdings, or any other font. There is a minor problem with using a different font, however, which is presumably why Mr. Corbitt suggests using the same font as in your document.

When you paste the character into your document, any text you type immediately after that character will be in the new font unless you add a format command to return to the default font for the document. This is enough of a chore that you probably wouldn't want to bother with it. Fortunately, you don't have to if you use a glossary data file.

First, you'll need to create such a file. (If you don't know how, open Ami Pro Help, search for Glossary, and read the topic Creating a Glossary Data File.) Create the glossary items following Mr. Corbitt's instructions for inserting bullet characters, using any font you like. Make sure you format the rest of the text in the glossary data file in the default font you normally use. (Do not try to insert the characters into a document file and then use Edit | Mark Text | Glossary to create the entries in the glossary data file. If you create the entries this way, Ami Pro will not record them with the right font.)

Once you've created the glossary file, inserting the bullets is as straightforward as using the Edit | Insert | Bullet command. Simply choose Edit | Insert | Glossary Record, or use the Ctrl-K shortcut, and pick the bullet name from the Glossary Items list. When you insert a character from the Glossary record, you'll find that the characters you type immediately after it use the font you used for formatting the rest of the glossary entry, not the font of the bullet character.

One last comment: Note that Character Map does not show the codes for all characters in the form Alt+0nnn. Characters that you can type from the usual typing keys show as the actual keystroke character: 6, m, M, and so forth. Although you can use these other characters and may be tempted to in a font like Symbol or Wingding, you shouldn't. If you ever need to replace them, Find and Replace will also replace the equivalent characters within your text, or leave you having to confirm each replacement.—M. David Stone

SPREADSHEETS

Inserting Links in Excel Sheets

I am using an Excel file as an index to keep track of all my reports prepared using a word processor and PowerPoint. Is there any way I can launch a document from Excel itself, once I choose a particular file to review? I do not want to attach the files, since they would clutter the index file. Can I create links such as the ones I see on Web pages?

ANUSRI VIDUDALA
via the Internet

PC MAGAZINE: In all recent versions of Excel, you can insert links to other documents, both Excel documents and documents created with other applications, and have those links appear as icons on your worksheet. Double-clicking on an icon for a linked document launches the document's parent application, which then loads the document. The link adds almost nothing to the size of the Excel file in which it's stored, and the icon takes up very little room on the worksheet.

To create a link to another document, follow these steps:

1. Select the cell where you want the link to reside.
2. Choose Object from the Insert menu.

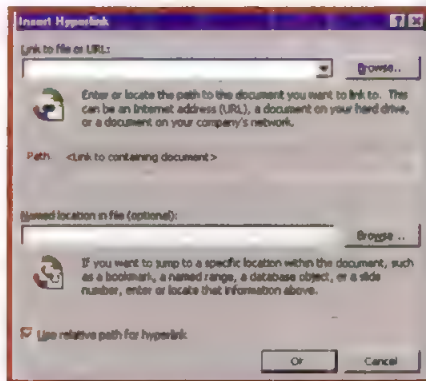


FIGURE 1: Excel 97's Insert Hyperlink dialog lets you specify documents or URLs to which to link.

3. Click the Create from File tab.
4. Select the check boxes labeled Link to File and Display as Icon.
5. Type the name of the file to which you want to link, or click the Browse button and navigate to it.
6. Click OK.

The link arrives as an object on the worksheet. Use the handles on the perimeter of the object to change the object's size, or grab any part of it and drag it to another spot on the worksheet. To copy the object to another location, you can right-click on it and choose Copy. To edit the link so that it points to a different document, click on the object once and choose Links from the Edit menu. You'll need to do this if you move or rename the document to which the object is linked.

In Excel 97, there's an even better way to set up links to other documents: the new Insert Hyperlink command. This creates a piece of underscored text that functions exactly like a link on a Web page. When you put your mouse over the link, the pointer changes to a hand and the full path or URL of the hyperlink appears in a pop-up window. When you click on the link, the linked document is loaded into its parent application. You can use Insert Hyperlink to create links to Web pages or to files. The files may reside on your own system, on a server, or at an FTP site.

The Insert Hyperlink dialog box, shown in Figure 1, has two edit fields and a check box. Use the first edit field to specify the name and path of the document or URL to which you want to link. If you're not sure of the name or path, click the Browse button and navigate to it. If you're linking to a URL you've visited recently, you may find it by clicking the downward arrow at the right side of the edit box.

In the second edit field, marked "Named location in file (optional)," you can specify a target location in the linked document. You can use this, for example, to jump to a particular cell or named range in an Excel document or a bookmark in a Word document.

The "Use relative path for hyperlink" check box is important if you use the Browse button to fill out the "Link to file or URL:" edit box. If the check box is selected, Excel fills out the edit box as a relative path. This may simplify the appearance of the link, but if you move the file containing the link, the relationship between the containing file and the link target will probably change and the link will probably stop working.

Should that come to pass, however, you can repair the link by right-clicking on it, choosing Hyperlink, and then choosing Edit Hyperlink.

Excel 97 also includes a HYPERLINK func-

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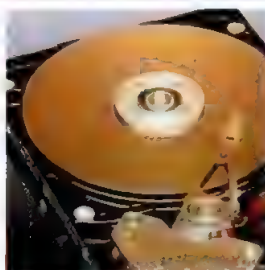
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tion, which builds a hyperlink from two text arguments. The first specifies the target location for the link (the same text that you would put in the first edit box of the Insert Hyperlink dialog), and the second specifies a "friendly name" for the link. The friendly name can be any descriptive text you want to use.

Hyperlinks can be an effective way to put all your everyday documents within a single mouse click. Moreover, once you've activated a hyperlink, the link text appears in the drop-down component of Excel 97's new Web toolbar. Selecting the text there reactivates the link, even if you're no longer working in the document where the link is stored.—Craig Stinson

DATABASES

Learning to Program and Customize Access

I'm using Microsoft Access to maintain a number of databases, but I'm not an expert VBA programmer. How can I learn more so that I can program and customize my databases?

DAVID SCAROTTA
Buffalo, New York

PC MAGAZINE: I suggest you start with a good introductory Access programming book. One that I like is Evan Callahan's *Microsoft Access/Visual Basic Step By Step*, published by Microsoft Press (331 pages, \$29.95). This book includes a lot of very practical exercises and introduces most of the topics you need to learn to become an expert Access developer. The copy I have is for Microsoft Access for Windows 95, but a new edition, for Access 97, should be available by the time you read this. You can reach Microsoft Press at 206-882-8080 or 800-677-7377, or via its Web page at www.microsoft.com/mspress.

Once you've gone through that book, consider continuing your education with Microsoft's CD-ROM *Mastering Microsoft Access Programming* (\$99), which focuses on developing for Microsoft Access for Windows 95. This is an interactive multimedia product intended for developers who already possess the fundamental programming skills taught in Callahan's book. The course begins with an introduction to Visual Basic for Applications in Access, and it goes on to include chapters on the following topics: programming with objects, debugging and error handling, working with recordsets, integrating Microsoft Office applications, using Windows DLLs, accessing external data, creating add-ins, distributing an application, class modules, OLE controls, database replication, and security.

You'll find narrated demonstrations and frequent diagrams and illustrations, and you can use the exercises to test what you've learned. These aids are a plus, because completing this course goes a long way toward preparing yourself for the Microsoft Access for Windows 95 and Microsoft Access Developer's Toolkit certification exam. I think that reading *Mastering Microsoft Access Programming* is an excellent way to study advanced topics, such as how to work with and program the Microsoft Access and Data Access Object (DAO) object models.

If you're using Microsoft Access 97 for Windows 95, then consider also the CD-ROM *Mastering Office 97 Development* (which includes information on programming and integrating other Office applications, such as Excel, Word, and Outlook). It's a good course to take right after finishing *Mastering Microsoft Access Programming*. For more information, contact Microsoft Corp. at 206-882-8080 or 800-426-9400, or visit its Web site at www.microsoft.com/mastering.

After you've completed the CD-ROM courses, another great way to learn is to experiment with code written by experienced developers. I know of two add-on products for Access that consist of libraries of pre-written code you can study and use with your own applications. The first is the Total Access Sourcebook (\$199), from FMS, which neatly organizes over 400 ready-to-run Access routines into a code repository. You can use the professional-looking code browser to view the library contents. You can also use the browser and repository to organize your own routines. As of this writing, support is available only for Microsoft Access 2, but a version for Microsoft Access for Windows 97 is promised and may be available by the time you read this. I highly recommend this product. You can reach FMS at 703-356-4700 or 888-220-6234 or, via its Web site, at www.fmsinc.com.

Start Developing for Access (\$139), by Moss Micro Systems, is a development framework for Access that provides a library of prewritten code and a collection of assistants; it currently includes versions for both Microsoft Access 2 and Microsoft Access for Windows 95. Start Developing offers a useful application wizard that helps you to create separate data and code databases and then to link them when your application starts—a must if you're going to be updating the application occasionally. It also includes approximately 250 Access routines and a number of assistants you can use to automate routine tasks, such as adding standard error-handling code to a module.

The product provides subsystems for error logging and event logging, too. For example, when you use the application wizard to start developing an application, Start Developing places tables for logging events and errors in your data database and puts the code required to perform the logging in your code database. You'll learn a lot by studying this product. You can contact Moss Micro Systems at 714-260-0300 or 800-608-6585 or, via its Web site, at www.mossmicro.com.

Once you've become comfortable with Access programming, you can turn to two advanced developer books that I regularly recommend, both by Ken Getz and Paul Litwin: *Microsoft Access 95 Developer's Handbook*, published by Sybex, and *Microsoft Access 95 How-To*, published by The Waite Group Press. Both are well-written and filled with useful and often unique information. You can reach Sybex at 510-523-8233 or 800-227-2346 or, via its Web site, at www.sybex.com; you can contact The Waite Group Press at 800-368-9369 or 317-581-3500 or at its Web site at www.mcp.com/waite.

Also consider visiting and participating in CompuServe's online Access forum (GO CIS:MSACCESS) and Microsoft's Internet newsgroups dedicated to Access, which you can find on Microsoft's news server msnews.microsoft.com (look for groups that start with microsoft.public.access). These are great places to ask questions and meet other people using and programming Access. Finally, don't forget to check out Microsoft's Access Developer Web page: www.microsoft.com/accessdev. It's a good source of up-to-date information.—Sal Ricciardi

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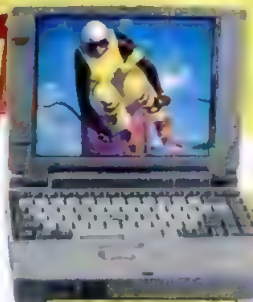
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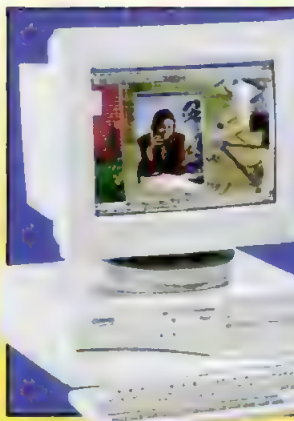
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1275MB	12ms	4500	Seagate	ST31276A	3	\$189
1280MB	11ms	4500	Quantum	TM31280A	3	\$185
1281MB	11ms	5200	Western Digital	WDAC11200	3	\$195
1624MB	10ms	5200	Western Digital	WDAC12600	3	\$199
1670MB	11ms	4480	Maxtor	M81750A	3	\$205
1700MB	10ms	5400	Fujitsu	M1623T	3	\$184
1700MB	12ms	4500	Seagate	ST31720A	3	\$199
2000MB	14ms	4103	JTS	JTS2000	3	\$195
2100MB	9ms	5400	Fujitsu	M1624T	3	\$218
2111MB	12ms	5200	Western Digital	WDAC21100	3	\$225
2132MB	12.5ms	4500	Seagate	ST32132A	3	\$219
2151MB	10ms	5400	Quantum	FB32160A	3	\$235
2168MB	10.5ms	4500	Quantum	TM32160A	3	\$220
2187MB	12ms	4480	Maxtor	M82187A	3	\$219
2500MB	9ms	5400	Fujitsu	M1636T	3	\$220
2550MB	15ms	3600	Quantum	BF2500A	3	\$220
2550MB	10.5ms	4500	Quantum	TM32550A	3	\$245
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3166MB	12ms	5200	Western Digital	WDAC3100	3	\$270
3228MB	10ms	5400	Quantum	FB3240A	3	\$309
3245MB	12ms	4500	Seagate	ST3240A	3	\$282
3254MB	10.5ms	4500	Quantum	TM3200A	3	\$279
3500MB	12ms	4480	Maxtor	M83500A	3	\$299
3840MB	10.5ms	4500	Quantum	TM3840A	3	\$309
4000MB	12ms	5200	Western Digital	WDAC34000	3	\$355
4310MB	10ms	5400	Quantum	FB34320A	3	\$375
4326MB	12ms	4500	Seagate	ST34340A	3	\$375
4335MB	14ms	3600	Quantum	BF4335A	3	\$259
5120MB	10ms	5400	Maxtor	M85120A	3	\$375
6448MB	10ms	5400	Quantum	FB36480A	3	\$539
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6510MB	14ms	3600	Quantum	BF6510A	3	\$379

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	Plexstor	12X	PK12CS	105ms	\$279	\$369
	Toshiba	12X	XM5701B	115ms	\$159	\$249
	Toshiba	15X	XM3801B	99ms	\$225	\$315
	NEC	16X	CDR1610	100ms	\$199	\$289
ATAPI IDE	Brand	Spin	Model	Speed	Int	Ext
	Mitsumi	8X	CRMCFX800	150ms	\$99	\$129
	Lite On	12X	LTN126A	155ms	\$105	\$135
	Acer	12X	AC612A	125ms	\$105	\$135
	Toshiba	12X	XM5702B	115ms	\$115	\$145
	Mitsumi	12X	CRMCFX12X	150ms	\$110	\$140
	Lite On	16X	LTN262A	120ms	\$120	\$150
	Mitsumi	16X	CRMCFX16X	120ms	\$135	\$165
	Acer	16X	AC706A	120ms	\$125	\$155
	NEC	16X	CDR1600	100ms	\$140	\$170
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1050MB	9ms	5400	Seagate	ST31055H	3	\$279	\$349
1200MB	12ms	4500	Quantum	TM32120S	3	\$239	\$309
2110MB	10.5ms	4500	Quantum	TM32110S	3	\$305	\$375
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2151MB	10ms	5400	Quantum	FB32160S	3	\$339	\$409
3228MB	10ms	5400	Quantum	FB3240S	3	\$389	\$459
3254MB	7.5ms	4500	Quantum	TM32200S	3	\$355	\$425
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4400MB	8ms	7200	Fujitsu	MZ954S	3	\$739	\$809
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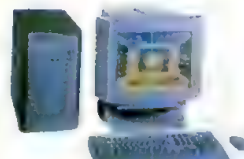


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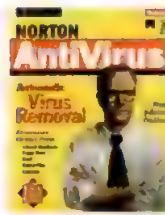
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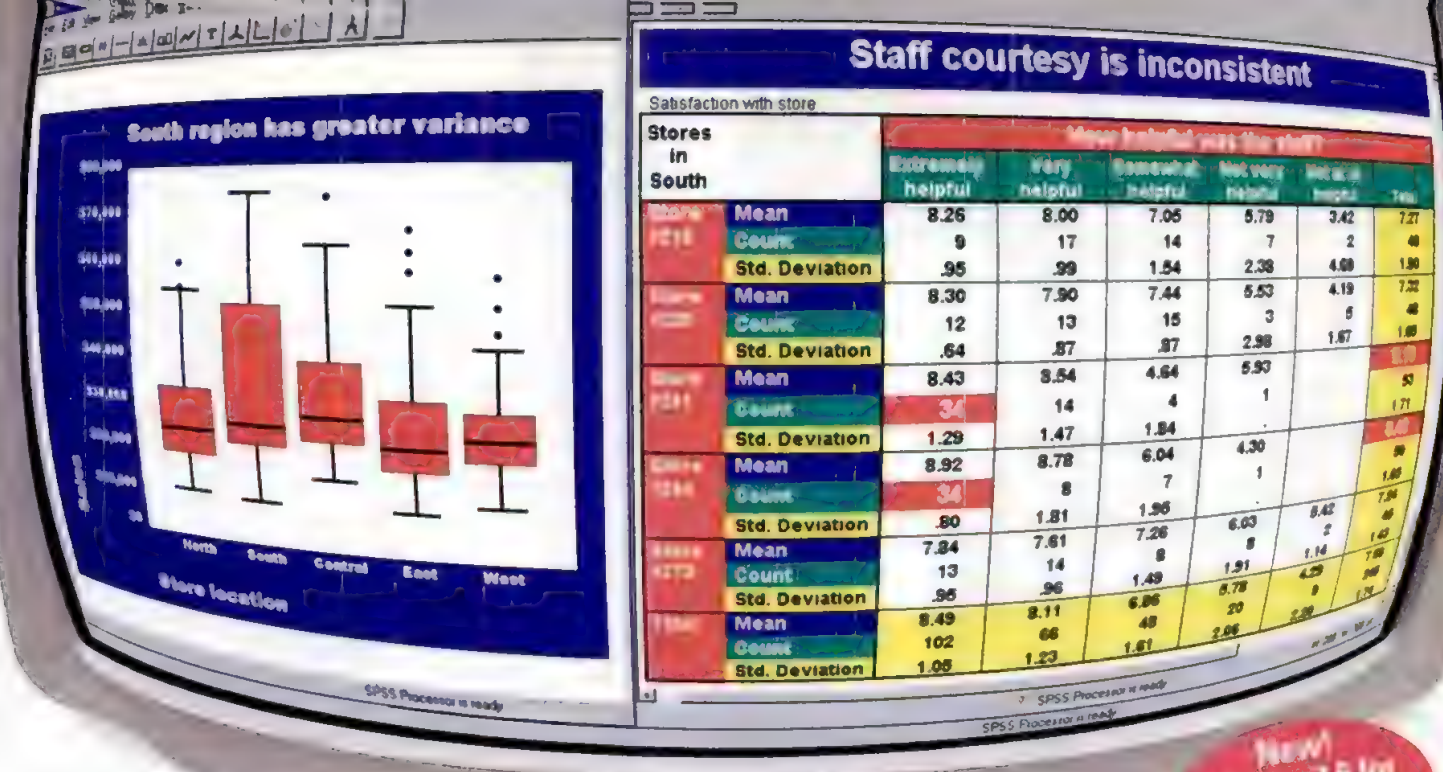
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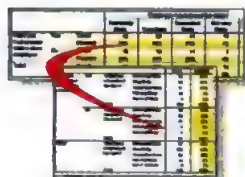
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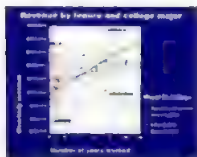
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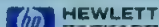
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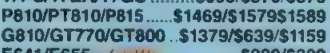
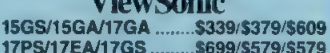
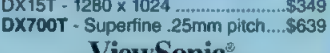
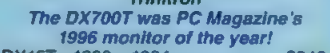
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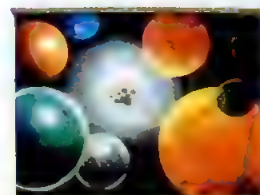
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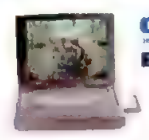
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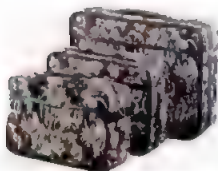


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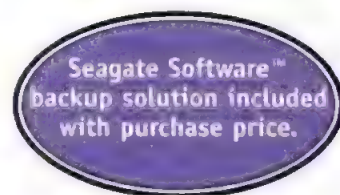
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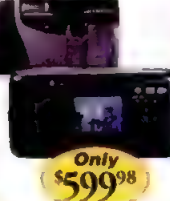
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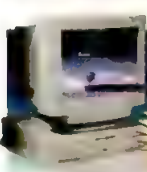
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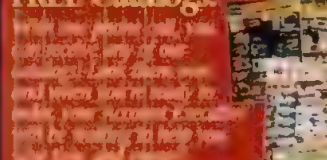


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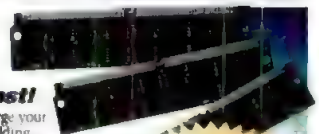
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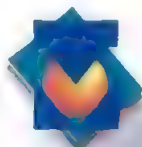
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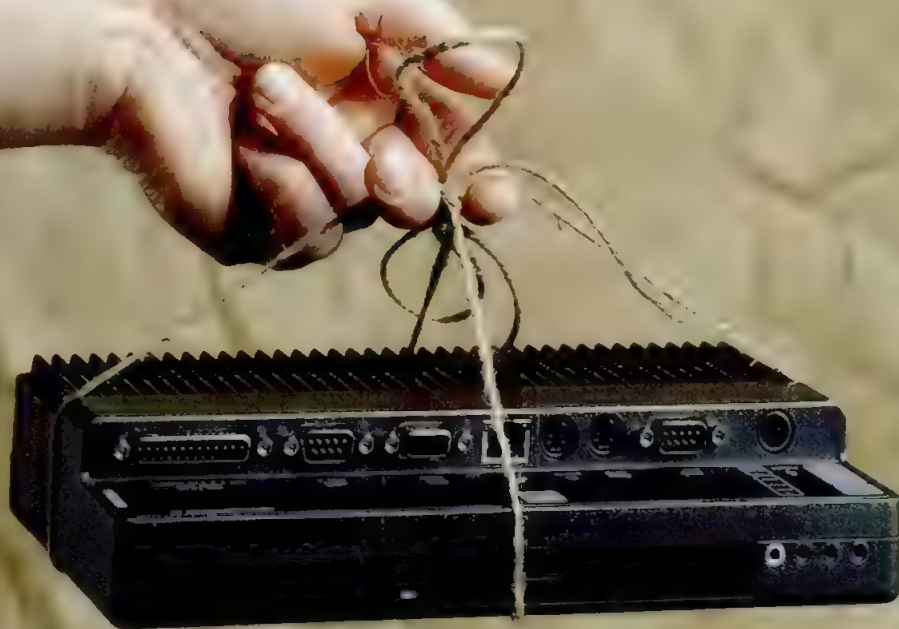


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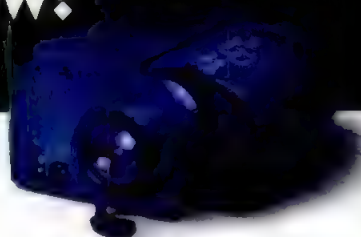
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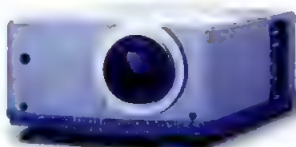
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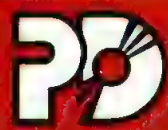
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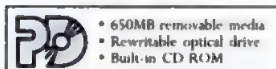


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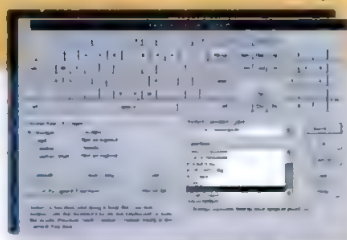
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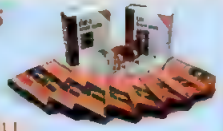
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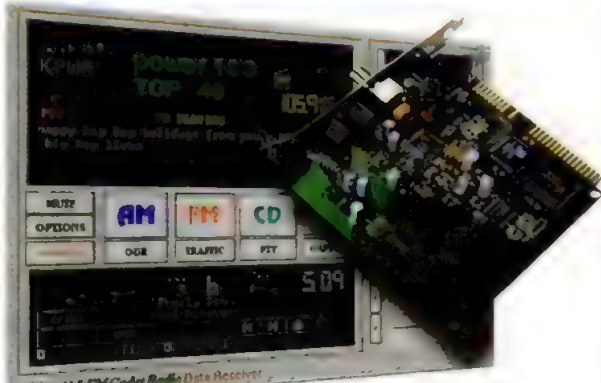
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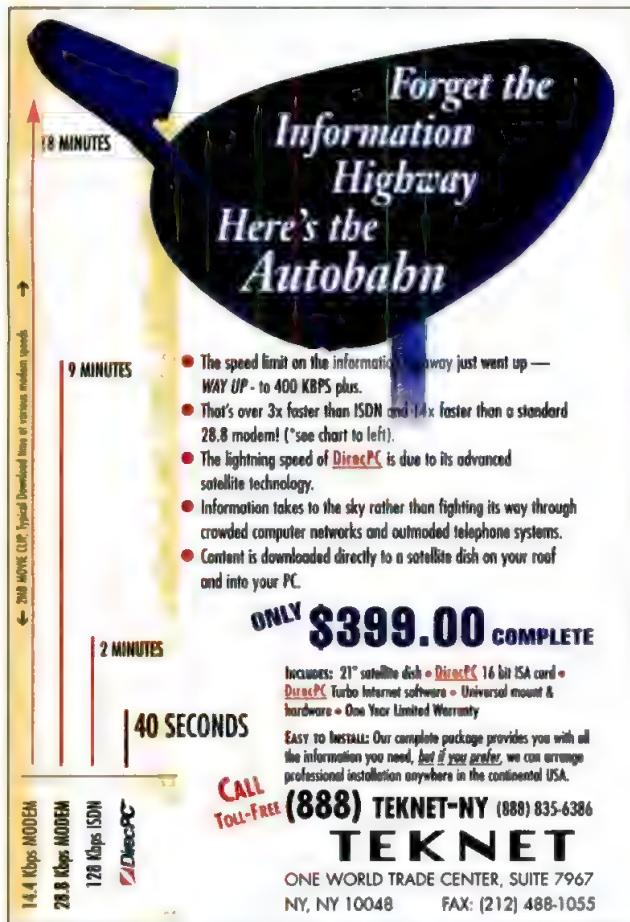
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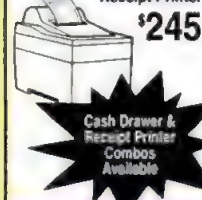
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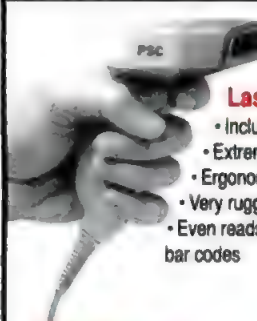
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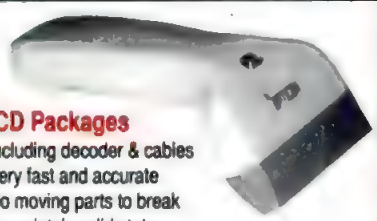
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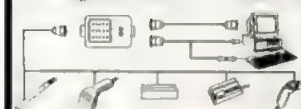
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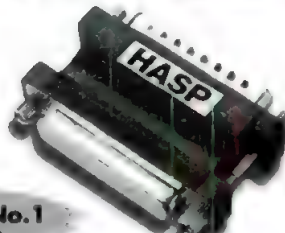
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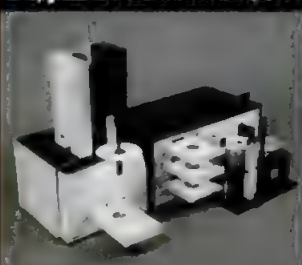
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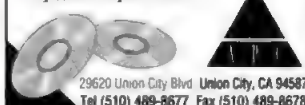
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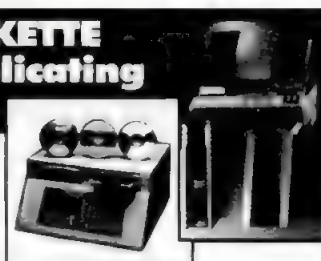
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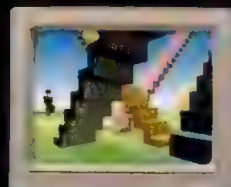
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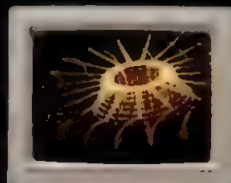
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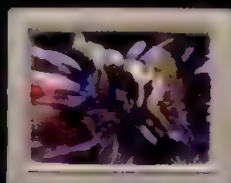
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After Hours

Mech Meets Mad Max

Activision's funky new game takes players to the streets and (even better) to the Internet for hard-driving action.

Imagine a world in which the energy crisis of the early 1970s never ended, and auto vigilantes in armed muscle cars rule the roads. This is the world brought to life in Activision's *Interstate '76*. The game has flaws, but is still a lot of fun—especially for any action fan with a passion for horsepower.

Interstate '76 is a Windows 95 game that requires a Pentium/90 with 16MB RAM and a 4X CD-ROM drive. Unfortunately, the game doesn't look good at this level, because you have to run it in 320-by-200 resolution and turn off some of the details. Even on a Pentium/166 with 32MB RAM, we had to turn off the sky textures to keep the game running smoothly at 640-by-480.

The game plays and looks much like *MechWarrior 2: Mercenaries*, only the action seems to come at you faster in *Interstate '76*. Also, because



you're driving a car and not a hulking sci-fi robot, the controls are easier to master.

In *Interstate '76*'s single-player mode, you play Groove Champion. Along with your newfound comrade Taurus (who sounds like Samuel L. Jackson's character in *Pulp Fiction*), you're on a quest to avenge your sister's death at the hands of evil auto mercenaries.

This single-player campaign comprises 17 rather difficult missions, and you must

complete each one in order to progress in the game. Unfortunately, the game has no adjustable difficulty setting, which we see as a serious flaw. Other flaws: Some of the longer missions are made up of segments, and you can't save your game in between.

Also, many of the missions each have only one solution—and it's far from obvious. In many cases, you'll end up re-playing a mission many times before completing it successfully, which can be frustrating.

If you do manage to survive a mission, you can scrounge around the battlefield, picking up salvage from other cars. Skeeter, your mechanic, can use these parts to fix and enhance your car. We loved this part of the game.

Between missions, the game's back story unfolds in a series of uniquely animated cut-scenes, which are both impressive and funny. So overall—if you can handle the difficulty—*Interstate '76* is a thoroughly enjoyable single-player game. As a multiplayer game, it's even better.

Interstate '76 lets two people play over modem and null-modem links; up to eight can play over LAN and Internet links. Activision has set up its own free Internet server for the game, and you can access this

server through your ISP connection right from the game. Log on and you can join in existing games or host your own. You can customize and drive any of the game's 25 cars. Game play here is like the ultimate destruction derby, with guns blazing, rockets exploding, and oil leaking everywhere. Performance over the Internet was surprisingly good, and we never had any trouble finding a game to join.

So if you're looking for some explosive automotive thrills, you need to get your hands on *Interstate '76*. Just keep in mind that the game can be frustrating at times.—Michael E. Ryan

INSIDE

FOOD FOR THOUGHT

Spark those culinary talents with one of these CD-ROM cookbooks. Page 362.



FINE, NEAR MINT, MINT

Got comic books? Now you can organize them with this thorough database tool. Page 370.

HOCUS-POCUS

MicroProse does justice to Magic: The Gathering. Page 370.



After Hours

Beyond Mac 'n' Cheese

Need help planning the next meal? One of these four CD-ROM cookbooks can help.

Ah, food. Who among us doesn't enjoy it? And who among us couldn't stand to have a solid collection of recipes?

The four CD-ROM cookbooks reviewed here are more than merely central databases for recipes. Their interactive nature means that you have several ways of searching for the right dish, and in some cases, there are video clips to demonstrate certain cooking techniques.

Though none of the four were impressive enough to warrant an Editors' Choice, we

your own menus to this list.

Fifty full-motion videos give helpful tips on such techniques as greasing a pan or icing a cake. But there are also some useless ones, like Types of Chocolates and Types of Potatoes, which are just montages of these foods backed by a big-band soundtrack.

One of the more useful features is the ability to scale a recipe automatically to fit the number of servings you plan to prepare. You can print recipes

on 3-by-5 or 4-by-6 index cards, and you can print either a full recipe with photo or just the text or ingredients only. Unfortunately, there's no print preview mode.

Compton's biggest assets are its good mix of both basic and exotic recipes and the fact that it gives you a number of different ways to search. But the interface is a bit cluttered, and compared

with other products reviewed here, Compton's offers little to distinguish it from the pack.—*John Moore*

Compton's Complete Interactive Cookbook

With a library of 2,500 recipes, Compton's Complete Interactive Cookbook is nothing if not comprehensive.

You can search for recipes by category (courses, ethnicity, garnishes, and so on). A menu planner features choices like Light Lunch, Kid's Choice, and Roman Feast; you can also add

the CD's fatal flaw. The recipes are so highfalutin' that reading them is like watching a Paris fashion show and wondering who would wear such clothes.

Great Chefs contains brief bios of the 93 featured chefs from 17 U.S. cities. The CD is divided into chapters; you can also search by city. A section on basic recipes and techniques shows how to make simple stocks and syrups.

Video clips show the chefs preparing selected recipes, but given the complexity of

most dishes, these clips are too brief to provide much useful information.

Navigating your way through Great Chefs can be tedious. When you click on a recipe, the program calls up a picture of the dish; you have to click a second time to call up the recipe. Recipes are scalable, but only after you save a copy in the My Recipes folder. There's no print preview, but



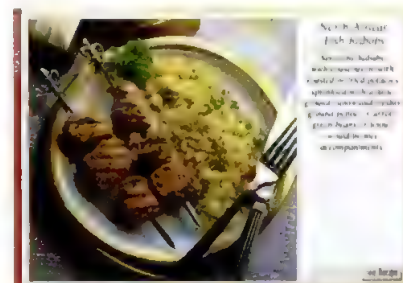
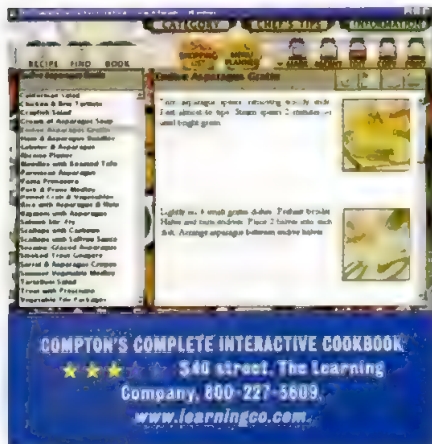
MasterCook Deluxe

MasterCook Deluxe is the only product in this roundup to feature a bartender's guide, so we were impressed. Joking aside, this is the most comprehensive CD-ROM cookbook in the group.

MasterCook Deluxe comprises eight cookbooks, which together provide a healthy supply of both basic and exotic fare. But it isn't impressive at first glance. The interface is nothing to write home about, and no pictures accompany the recipes.

MasterCook Deluxe does have a nice collection of helpful video tips, however, so you can see how to poach an egg or prepare a roux. You can view a nutritional analysis for each meal or beverage, or for each ingredient. You can view recipes not only by ingredients or category but also by calories, percentage of fat, and so on.

MasterCook Deluxe even tells you where to find each ingredient in the supermarket. But because it doesn't help out with more exotic ingredients, this feature seems more condescending than helpful. Printing features are



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adequate, even though there is no way to adjust the size of the output (which is rather small).

It's not pretty or perfect, but in terms of both quality of recipes and interactive features, MasterCook Deluxe should be a solid addition to any digital kitchen.—JM

Williams-Sonoma Guide to Good Cooking

If only browsing through this CD were as much fun as browsing through a Williams-Sonoma outlet! We were confronted with problems from the start: The CD, which requires your PC to operate in 16-bit-color mode, changed our system's display settings to 16 colors.

Williams-Sonoma Guide also requires 37MB of disk space, by far the most of the products reviewed here.

Beyond these difficulties, we found the CD pretty help-

ful. For each recipe, you can view a list of equipment you need, the techniques you have to perform, nutritional information, and the amount of time for preparation and cooking. Clicking on various techniques, such as chopping vegetables, will cue up a video demonstration. The recipes run toward the gourmet side (orange-oatmeal lace cookies, fried oyster BLTs).

The solid—and fast—search engine lets you query recipes by region, ingredients, cooking time, season, and dietary preferences. Though the CD doesn't support printing on index cards, the print preview mode was very accurate and the output was superb.

Williams-Sonoma Guide to Good Cooking is fine if you're looking for a variety of exotic dishes. But be prepared to fork over the system resources.—JM

QUICK CLIPS

Fable



A fun and funny cartoon-style adventure similar to the Monkey Island and King's Quest titles. You must help young Quickthorpe recover four magic jewels to restore his world to its former glory, soaking up the rich humor and excellent animation all the while. \$35 street; Sir-Tech Software, 800-447-1230, www.sir-tech.com.

Major League Math—Second Edition



This well-designed learning tool uses baseball to help kids field basic math skills. We're not sure why correct answers sometimes translate into outs, but if it helps a young baseball fan with math, we're all for it. \$29.99 list; Sanctuary Woods, 800-934-3664, www.sanctuary.com.



CyberMom



We thought this calendar/day planner would be cute and funny—a digital mother who reminds us of meetings and important events (like Mother's Day). We were wrong: It crashes often; even when it works, it's more annoying than cute. \$25 street; The Kuester Group, 612-535-8333, www.cybermom.com.



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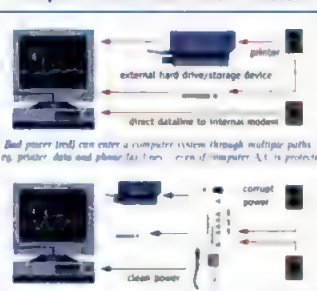
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This database for Windows 3.1x or later includes data on more

than 100,000 comics, as provided by Wizard magazine (a

monthly publication about comic books).

Using the intuitive, well-designed interface, you tell the

application which comics you have. Be warned, this can take quite a long time, especially if you have a collection of hundreds of titles.

Then you can organize and track your collection according to a variety of criteria such as title, artist, character appearances, and approximate market value. You can create lists of the comics you want to buy or sell and those that are your favorites.

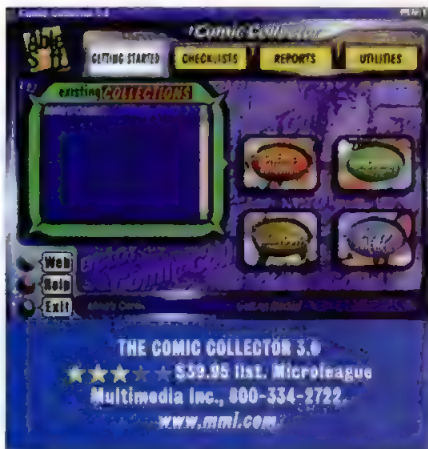
The Comic Collector also lets you scan in an image for each comic (such as the cover), although that seems as if it would be more trouble than it's worth.

The program

comes with a few basic reporting options, including a basic collection inventory list, and it generates excellent printed output. You can create your own

reports as well, although this feature is not as open-ended as we would have liked: No matter what you want your report to show, some fields will always appear (three different value fields, for example).

The Comic Collector 3.0 is definitely a one-trick pony and will be useful only for comic-book collectors. But if you fall into that category, you should be pleased with it.—MER



Now *That's* Magic

Despite its lack of multiplayer support, this cult-classic card game is a winner.

Magic: The Gathering

Two issues ago, we told you about a disappointing PC title based on the card game Magic: The Gathering ("Smoke and Mirrors," May 6, 1997). Another computerized version of that game is now out, and we're happy to report that it is much more impressive. In fact, MicroProse's Magic: The Gathering is about as faithful a translation of the card game as you're ever going to see.

In the analog world, Magic is played with a deck of cards. The goal is to beat your opponent by playing a series of cards that will summon up monsters and cast spells. The greatness of the game stems in part from the availability of hundreds of cards with which

one could build a "killer deck."

In MicroProse's Windows 95 version of the game, which requires a 486/100 with 16MB of RAM and a 4X CD-ROM drive, the cards are replaced by beautifully detailed digital images and the human opponents by computer foes.

The game is divided into four parts: a tutorial, a deck builder, a duel, and an adventure game. The tutorial is a full-motion video overview of the game brought to you by a couple of actors dressed as wizards. This is definitely the place to start (Magic is an incredibly complex game), but try to avoid the temptation to judge the game by the cheesy look and dialog of the lessons.

The deck builder is a

Magic fan's dream, allowing you to customize your deck using more than 400 cards so that you'll be ready for any duel. And you'll need it, since the adjustable computer opponent during a duel is tough.

The adventure-game portion sees you journeying through Shandalar, a randomly generated world in which you must vanquish evil forces

by dueling various sorcerers, priests, and other nasties.

Incredibly, this game currently has no multiplayer options (these are promised in an expansion pack). Also, it crashes every once in a while. Despite these annoyances, Magic: The Gathering is a well-designed game and a near-perfect translation of the card game.—Shane Mooney



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April 22, 1997
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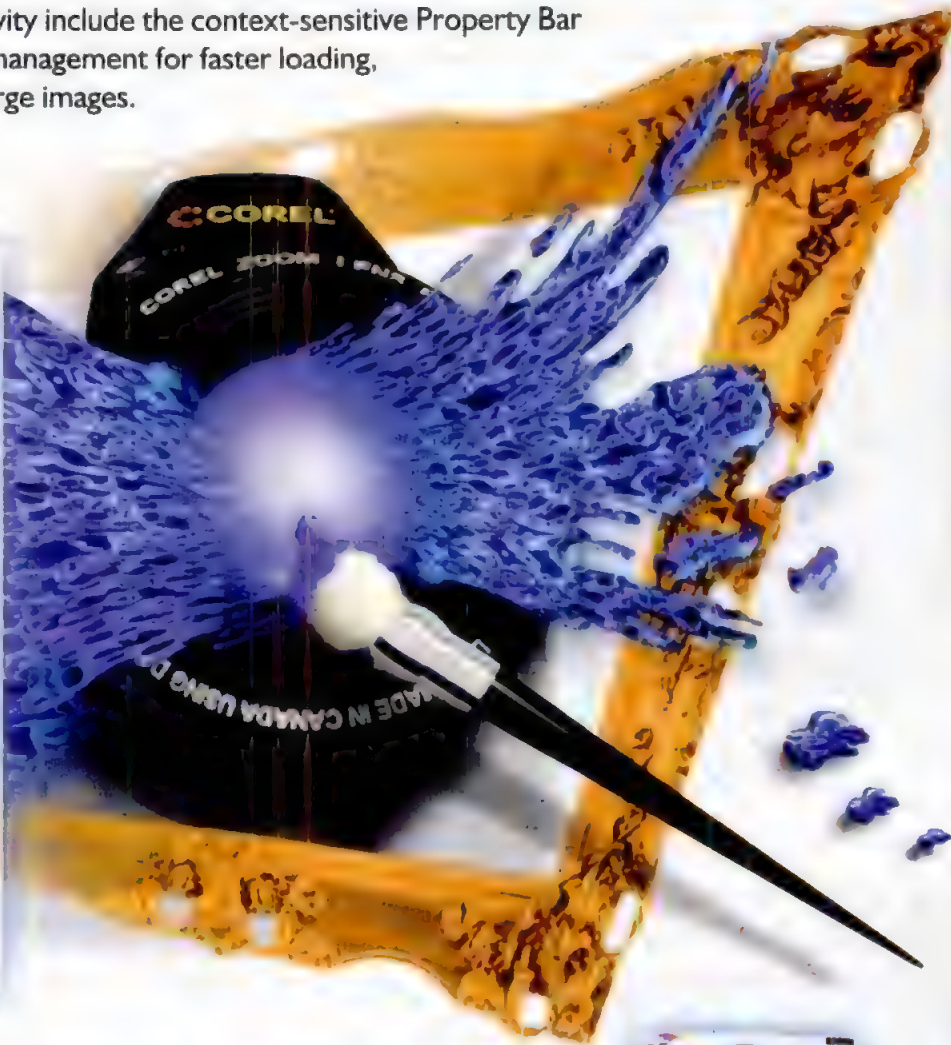
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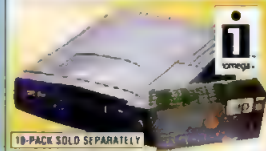
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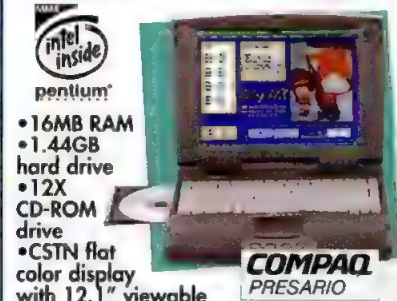


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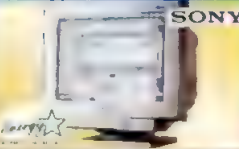


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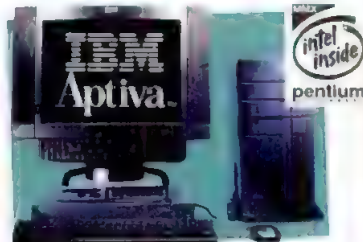
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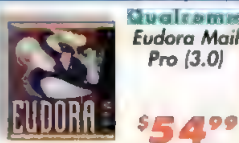
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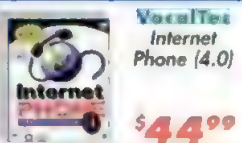
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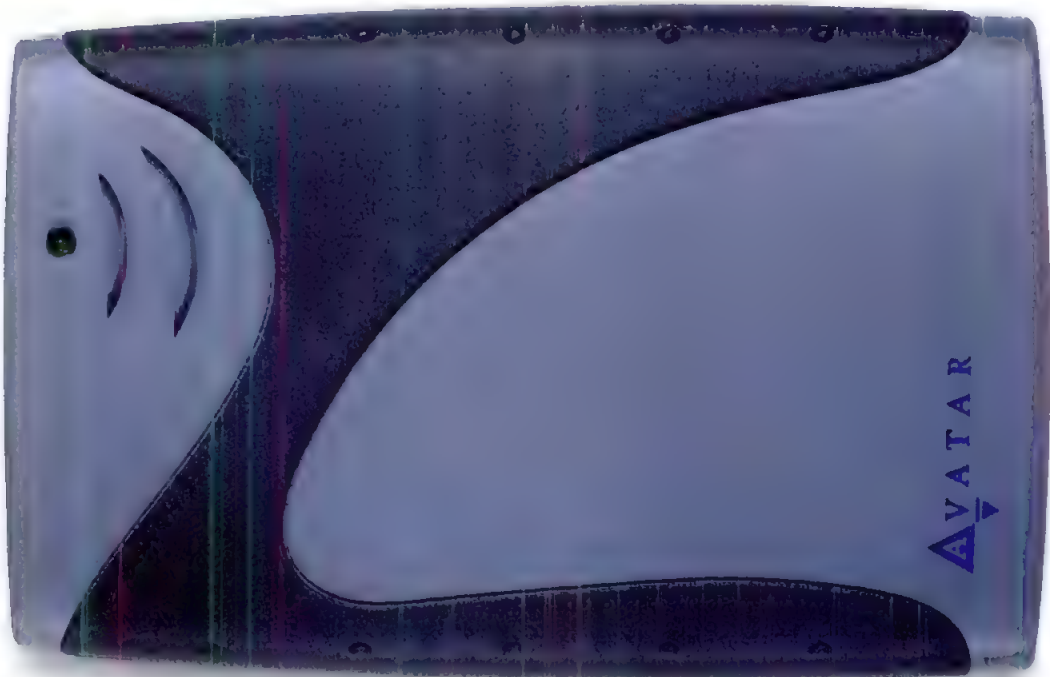
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Coming Up

What's in the Next Issue of PC Magazine

PCs for the Business Desktop

MMX got to the business desktop fast. For now, it delivers smoother video and better audio; eventually we'll see MMX-enabled business apps. We review more than 60 new systems that incorporate Intel's new multimedia technology—and also note a smattering of PCs that comply with Intel's DMI 1.1 spec.

Graphics Boards

Our annual roundup of mainstream graphics enhancement boards covers 2-D and 3-D models for business and games. Prices drop lower every year, yet we're seeing some of the best 2-D performance ever. This roundup also marks the debut of our newest benchmark test program, ZD 3D WinBench 97.

21-Inch Monitors

Is it time for a bigger view of your electronic world? We test 17 high-resolution, high-refresh monitors designed for CAD, graphics, and Web-design professionals. Though 21-inch monitors still command a price premium, they will be welcome to anyone who has lived with a smaller monitor for too long.



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NE—Network Edition.

For information about the Network Edition of PC Magazine, call Circulation at 800-289-0429.

Abort, Retry, Fail?



Six issues ago, we invited you to write limericks with Internet themes, and you certainly rose to the poetic challenge—although some entrants were just a little too bawdy for a family-friendly magazine. The three winners (in bold type) were carefully selected from among 700 entries by a certified board of limerick experts and Internet gurus. We've included some deserving semifinalists, too. Enjoy!



**There once was a monk in Tibet
Who ached to join the Internet.
He'd bought a fast modem
When somebody told him,
"ISPs aren't near Lhasa yet."**
—Richard Tjoa

**A crusty goat said with dismay:
"Computers aren't all that they say.
They treat 'garbage in,
Garbage out' as some sin.
It's made me what I am today!"**
—MarthaJo Fleischmann

**We're awaiting the network computer.
It's sort of akin to a scooter.
A bit slow, a bit small,
No hard disk at all.
Just like my PC, only neutered.**
—Greg Dean

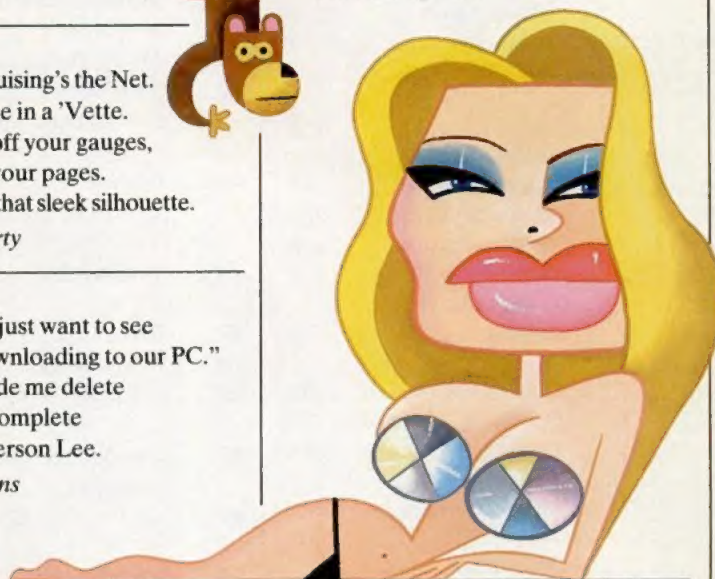
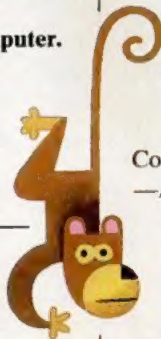
**The venue for cruising's the Net.
It used to be done in a 'Vette.
You'd show off your gauges,
But now it's your pages.
They don't have that sleek silhouette.**
—Emery Swagerty

**My wife said, "I just want to see
What you're downloading to our PC."
Then she made me delete
All my files complete
Of Pamela Anderson Lee.**
—Nadine Martens

**A circadian cycle is prime.
Regular, even sublime.
But to get on the Net,
The best method yet
Is a 3 A.M. signing-on time.**
—Benn Clouser

**A brilliant young fellow named Mel
Wrote incomparable HTML.
But his gigantic GIFs
Were such slow-loading stiffs
That he created the Web site from Hell.**
—Les Share

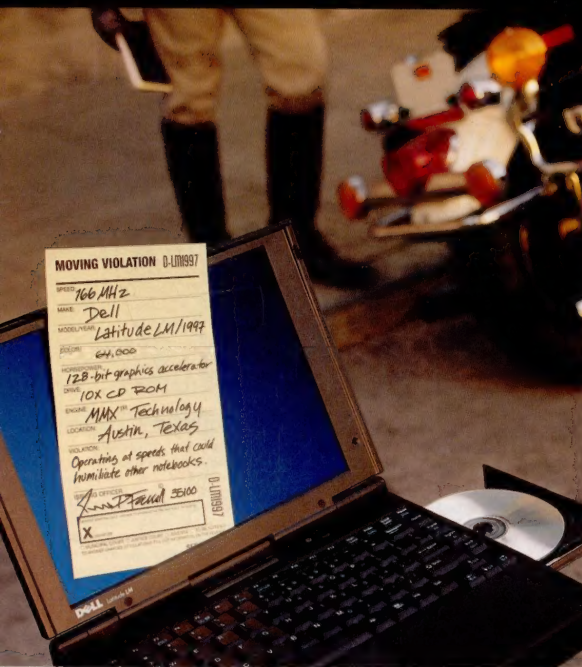
**The Web has been often attacked
As a jungle, unruly, smut-packed.
But nothing is worse than
And no words more cursed than
Communications Decency Act.**
—Howard Spindel



If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802 or via e-mail (text items only) to don_willmott@zd.com.

ILLUSTRATIONS BY ROBERT DE MICHELL

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